

AUTOMOTIVE INDUSTRIES

A CHILTON PUBLICATION

DECEMBER 1, 1959

Features • • •

**WELDING, PRIMARY
PRODUCTION METHOD
FOR MOTOR VEHICLES**

**ASSEMBLING THE
DODGE DART**

**FORD'S FOUNDRY
IN BRITAIN**

**THE METAL SHOW
IN REVIEW**

welders at work ➤

Welding 1960 Unitized
Plymouth Bodies at the
Plymouth Detroit Plant
PAGE 43



**ENGINEERING
MANAGEMENT • • PRODUCTION
DESIGN**

PERFORMANCE REPORT



R. J. Huff, Granite City maintenance superintendent, points out Morgoil bearings to J. H. Koester, Granite City lubrication engineer, and W. P. "Sandy" Wehking of Standard Oil.

How **STANOIL** *Industrial Oil has been delivering on 22-year assignment at Granite City Steel*

Situation: In 1937, Granite City Steel installed STANOIL Industrial Oil in the Morgoil Back-up Roll Bearings in the five-stand finishing train of their hot strip mill. Each bearing has a load-carrying capacity of more than three million pounds. The oil on which these bearings ride must be of high quality to meet the requirements of this severe service. A narrow viscosity range is required to assure proper operation of the mill throughout the speed range. More than 10,000 gallons of water per minute cool the work rolls. The oil thus must have superior demulsibility to prevent water contamination.

What has happened: Today approximately 1,800 tons rolled is the average shift production. A record of over 2,700 tons rolled has been racked up by one shift in this mill. STANOIL Industrial Oil has continued to deliver top operating performance under these increasingly demanding conditions. Samples of the oil are taken regularly by the Standard Oil lubrication specialist for laboratory analysis to make sure the oil is maintaining specifications. Stocks of STANOIL Industrial Oil are warehoused by Standard at East St. Louis, only twelve miles away, so that the mill has a ready source for the product whenever needed.

What you can do: Get all the facts about STANOIL Industrial Oil from the Standard Oil lubrication specialist near you in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.**



*You expect more from Standard
and you get it!*

Bearing assembly viewed from inside by J. H. Koester and Sandy Wehking. Sandy Wehking knows industrial lubrication. For 17 years he's been providing lubrication technical service to industrial customers. He studied chemistry at Blackburn College and has completed the Standard Oil Sales Engineering School.



**Plant produces 3800 tons
of aggregate daily...**



Courtesy — Iowa Manufacturing Company, Cedar Rapids, Iowa

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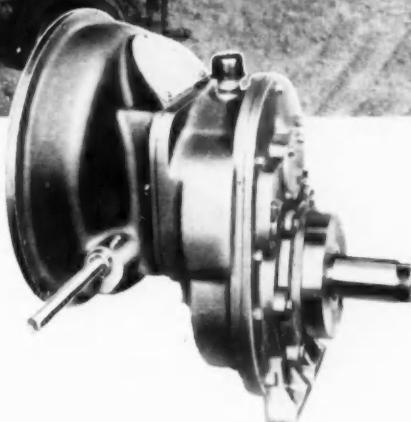
This CEDARAPIDS Commander crushing and screening plant, operated by the Maudlin Construction Company of Webster City, Iowa, on a strenuous 10 hour schedule, produces 380 tons of minus $1\frac{1}{2}$ " aggregate every hour.

Cotta Transmissions are precision built by specialists skilled in the manufacture of heavy-duty power transmissions and gear reducers . . . extra assurance of dependability and long service.

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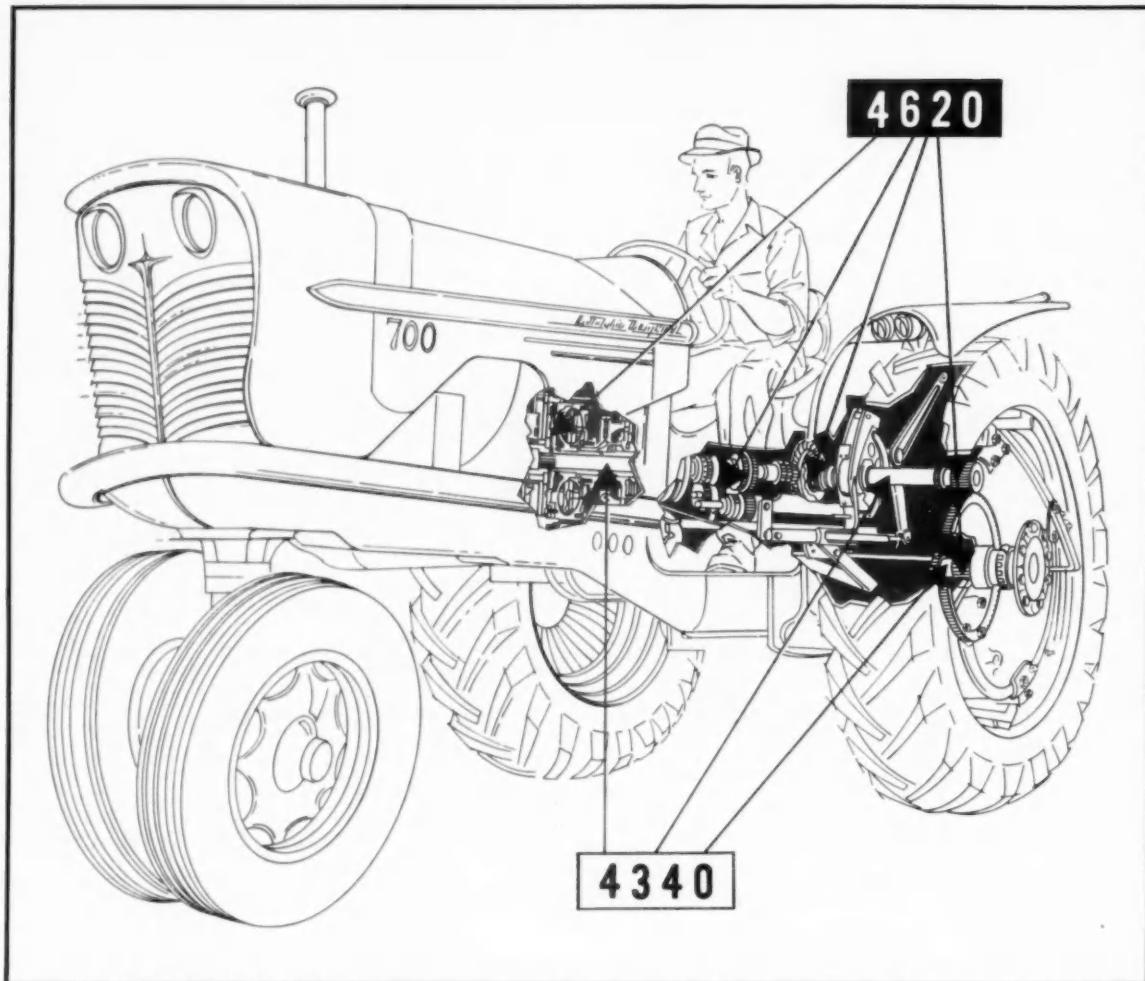


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These two General Purpose alloy steels can solve most of your steel selection problems. One a carburizing type, the other a through-hardening type — with just these two grades you can satisfy practically all your alloy steel requirements.

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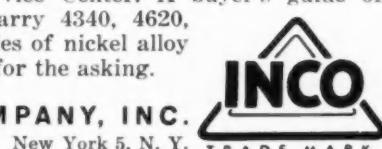
heat treatment. It's weldable under proper conditions and machines at relatively high hardness.

And when you need a carburizing steel, simply specify 4620. It resists warpage and distortion in heat treatment. Responds reliably and uniformly, too. Provides a tough, strong core to support the hard, wear-resisting case.

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THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street



AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE • PUBLISHED SEMI-MONTHLY

DECEMBER 1, 1959

VOL. 121 No. 11

Features • • •

Passenger Cars • Trucks • Buses • Aircraft • Tractors
• Engines • Bodies • Trailers • Road Machinery •
Farm Machinery • Parts and Components • Accessories
• Production and Processing Equipment •
Design • Production • Engineering • Management

▼ Welding for Motor Vehicle Production

The automotive industries are major users of many types of welding. This first part of a four-part series deals with some arc welding methods.

Page 43

▼ American Zinc Institute Symposium

New and improved processes for the electroplating of zinc die castings were brought out at the symposium conducted in Detroit by the American Zinc Institute.

Page 47

▼ Assembling the Dart

Many new techniques are employed in assembling the Dart in the Dodge Hamtramck plant. Joseph Geschelin describes some of them in a well-illustrated article.

Page 48

▼ Ford's New Foundry in Britain

Ford's fully automated Thames foundry has a capacity of approximately 400 tons per day of finished castings. It produces cylinder blocks, heads, and large tractor components.

Page 52

▼ Metal Show in Review

Although the Metal Show was previewed in the November 1 issue of AI, only a small part of the 400 exhibits could be covered. The present article describes some of the other interesting exhibits.

Page 54

▼ Radioisotopes Advance in Automotive Engineering Part II

Part II is a comprehensive round-up story on the actual uses to which radioisotope equipment has been adapted in the automotive factories, and also in the automotive vendor plants. It gives factual information on many present and potential uses of radioisotopes.

Page 56

▼ Combined SAE Meetings

New materials and designs were discussed at the combined Transportation, Diesel Engine, and Fuels and Lubricants meeting of the Society of Automotive Engineers in Chicago.

Page 64

▼ Computer Cuts Costs

Use of a computer for processing data from many sources on a missile contract has reduced clerical costs by half at Bendix Products Division, Bendix Aviation Corp.

Page 64

▼ Liquid-Cooled Brakes

With higher speeds and heavier loads, heating of brakes on commercial vehicles is becoming more of a problem. Results of tests of liquid-cooled brakes for stopping and for retarding are given in a one-page article.

Page 78

▼ 18 New Product Items, And Other Features, Such As:

Metals Report, Industry Statistics, and Observations.

... continued on next page

MEMBER



National Business Publications, Inc.



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Business Publications Audit of Circulation

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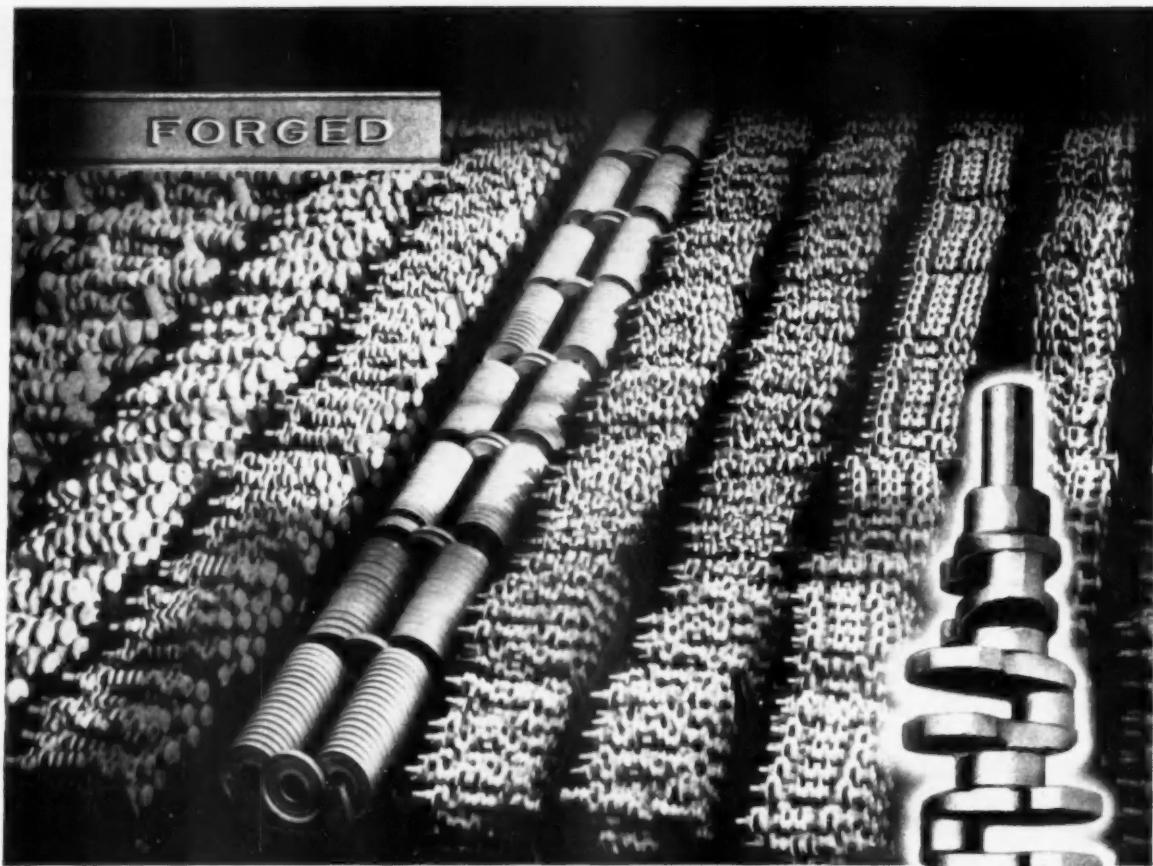
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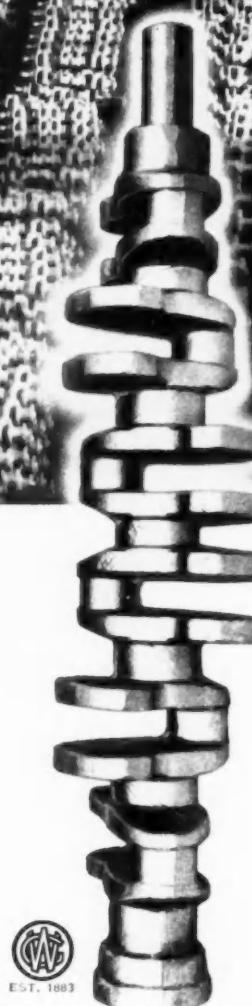


On their way to move men, merchandise—or mountains

For a nation on wheels and on the wing—a production run of forged crankshafts and jet engine compressor wheels for the builders of power-plants for pleasure cars, trucks, earth-moving equipment, and aircraft.

In missile development, too, Wyman-Gordon has proved the value of forging in achieving the highest strength-weight ratios, at elevated temperatures.

With forging experience dating prior to the birth of the internal combustion engine; with the greatest hammer and press capacity in the country; with unexcelled laboratory facilities; Wyman-Gordon is anxious to serve you at the design, engineering and purchasing stages of your developments.



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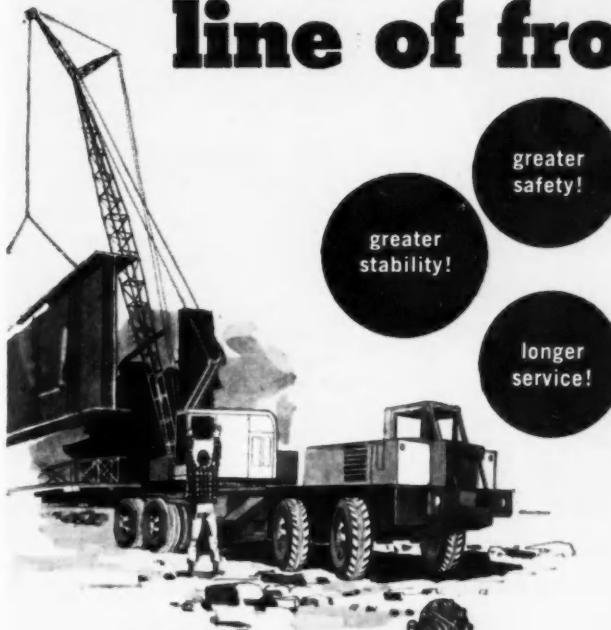
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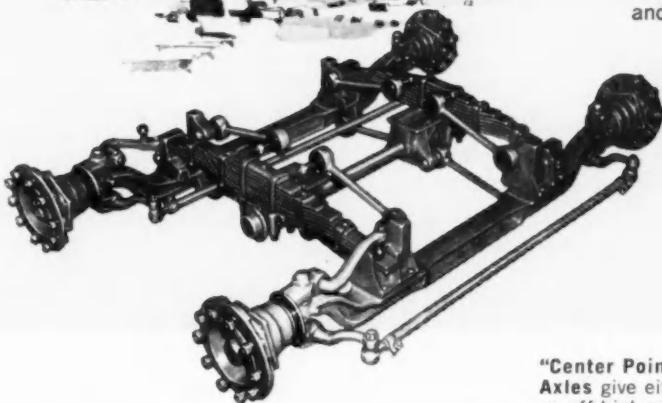
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service!

You get these three important advantages when your vehicles or equipment ride on Timken-Detroit F-900 Series Front Axles by Rockwell-Standard.

Whatever you operate — from light commercial vehicles to the heaviest off-highway equipment — there is an exact size and type of F-900 Series Front Axle to meet your need.

Superior design and construction features assure better performance under all conditions. These improved front axles reduce driver fatigue . . . make steering easier . . . hold the driving path better . . . help to prolong vehicle life.

In addition to the F-900 Series Axles, the following two new front axles are available from Rockwell-Standard. Each is the product of more than 50 years of field testing and laboratory research.



Tandem Front Steering Axles provide two non-driving front axles that increase maneuverability and double the front axle carrying capacity on special off-highway vehicles.

"Center Point" Steer Front Axles give either on-highway or off-highway vehicles the advantages of easy steering without the additional cost penalties of power assistance.



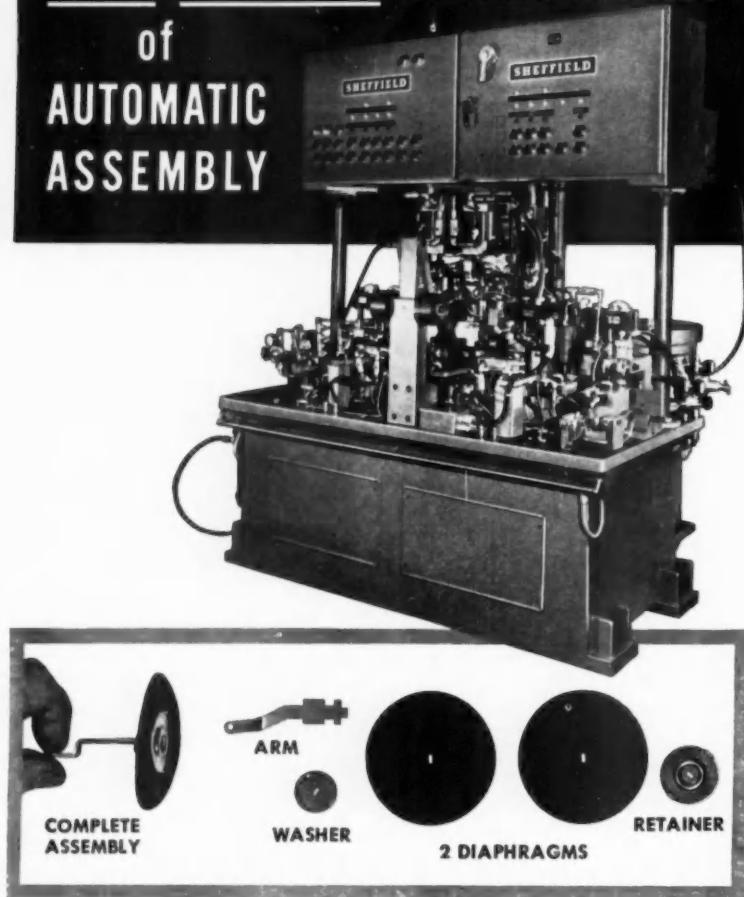
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Transmission and Axle Division, Detroit 32, Michigan



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CALENDAR

OF COMING SHOWS AND MEETINGS

ASME, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Nov. 30-Dec. 4

Ninth Annual Eastern Joint Computer Conference, Statler-Hilton Hotel, Boston, Mass. Dec. 1-3

Automotive Electric Association, annual meeting, Edgewater Beach Hotel, Chicago, Ill. Dec. 4-11

Material Handling Institute, annual meeting, Savoy-Hilton Hotel, New York, N. Y. Dec. 15

Industrial Truck Association, annual meeting, Savoy-Hilton Hotel, New York, N. Y. Dec. 15

1960
 SAE Annual Meeting, Sheraton-Cadillac and Statler Hotels, Detroit, Mich. Jan. 11-15

Society of Plastic Engineers, 16th National ANTEC Meeting, Conrad Hilton Hotel, Chicago, Ill. Jan. 12-16

AIME Annual Meeting, Statler-Hilton and McAlpin Hotels, New York, N. Y. Jan. 14-18

National Motor Boat Show, Coliseum, New York, N. Y. Jan. 15-24

Chicago Automobile Show, International Amphitheatre, Chicago, Ill. Jan. 16-24

Plant Maintenance & Engineering Show, Convention Hall, Philadelphia, Pa. Jan. 25-28

AAMA Exposition, Navy Pier, Chicago, Ill. Jan. 25-28

Institute of the Aeronautical Sciences, Hotel Astor, New York, N. Y. Jan. 25-28

Society of Vacuum Coaters, annual meeting, Hotel Biltmore, New York, N. Y. Jan. 26-27

Private Truck Council of America, annual convention, Roosevelt Hotel, New York, N. Y. Jan. 28-29

NADA Annual Convention and Exhibition, Washington, D. C. Jan. 30-Feb. 3

ISA Instrument - Automation Conference and Exhibit, Coliseum, Houston, Tex. Feb. 1-5

SPI Reinforced Plastics Div. Conference, Edgewater Beach Hotel, Chicago, Ill. Feb. 2-4

IASI International Show, The Coliseum, New York, N. Y. Feb. 10-13

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covering the issues from January 1 to June 15, 1959, inclusive

Your copy of the newly revised Editorial Index is now available. This handy Index saves valuable time in searching for specific subjects covered in the past issues of **AUTOMOTIVE INDUSTRIES**, and is made available to you as an additional service.

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NUMBER
12

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**Unequaled in its size range, in versatility,
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Whether it's for continuous operation in mass production or a wide variety of parts in small lots, this machine is in a class by itself.

Faster automatic cycle. The No. 12 is a fully automatic chucking lathe, capable of performing all types of machining operations in rapid sequence. With 420 spindle speeds ranging from 40 to 2600 r.p.m. and an infinite selection of feeds, it meets every requirement for stock removal, finish and minimum f.t.f. time.

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Boosts operator productivity. It requires a minimum of operator skill and attention—allows him to handle additional machines.

With all its speed and ruggedness, the No. 12 has the extreme flexibility of motions to handle practically any machining job on parts up to 16½" in diameter. It delivers high production with consistent accuracy and less dependence than ever on operator skill.



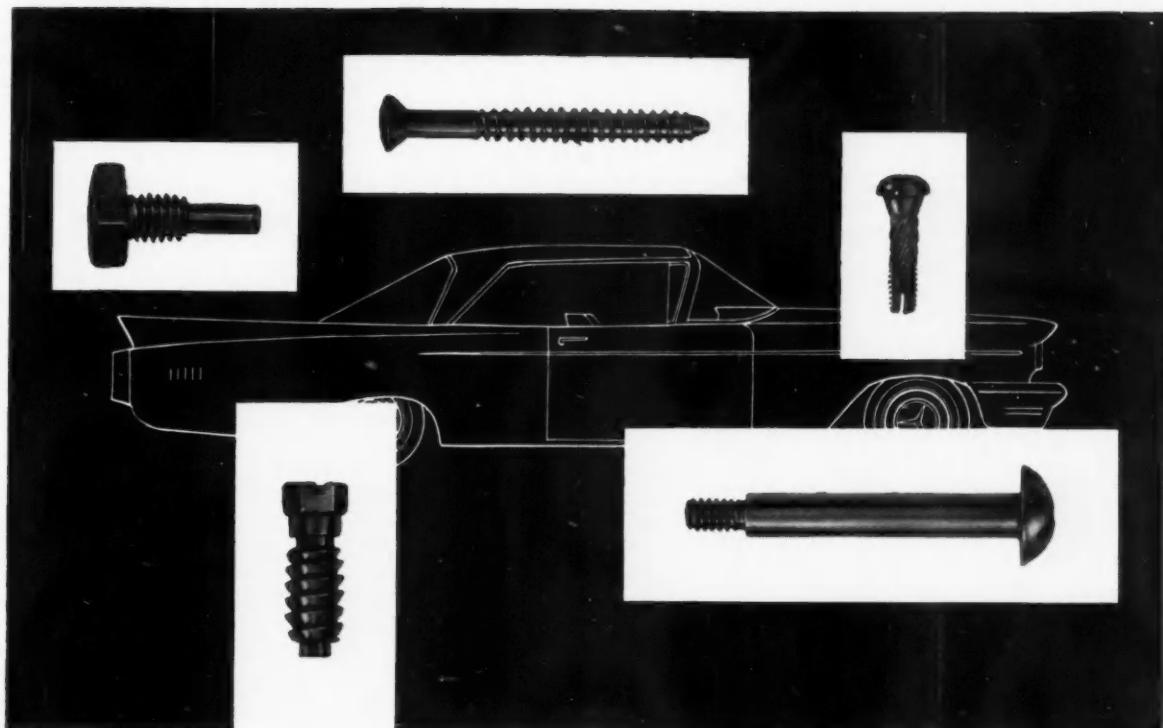
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If you have a problem concerning the use of stainless steel fasteners, see your fastener manufacturer. If he has any questions about stainless steel cold heading wire, AS&W metallurgists can work

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SHORT TOOL LIFE due to chip weld, cratering and burning, in many cases, has been traced directly to lube oil dilution of cutting oil effectiveness. Cleartex can end this problem forever.

Diluted cutting oil shortens tool life drastically

Lubricating oil is probably leaking into the cutting oil sumps of your automatic screw machines as you read this. Current research proves that this is happening in 70% of all the automatics in use today! And where it happens, it shortens tool life by as much as 50%—even 70%. On top of this, the cost of extra regrinds, lost production during tool changes, and excessive scrap production is putting a premium on screw machine operation in too many shops.

Look for these symptoms. One sure sign of dilution is the need for frequent refilling of the lube oil sump. If you are using an ordinary lube oil, this dilution will create two additional—and more costly—symptoms: excessive scrap production and frequent regrinds. Now you can eliminate these forever with the

TEXACO CLEARTEX CURE

The exceptional chemical stability and load-carrying ability of Texaco's Cleartex series make them equally suitable for use as cutting oils, lubricants or hydraulic fluids. All you have to do is use them for both cutting and lubrication. With Cleartex in *all* your sumps, you'll find cutting oil dilution will stop and screw machine production cost will drop substantially.

Write today for your copy of Texaco's helpful new booklet "Cleartex in Automatic Screw Machines" ... and contact your local Texaco Lubrication Engineer for an authoritative survey of your automatics. Just call the nearest of the more than 2,000 Texaco Distributing Plants, or write Texaco Inc., 135 East 42nd Street, New York 17, N. Y. Dept. AI-24.

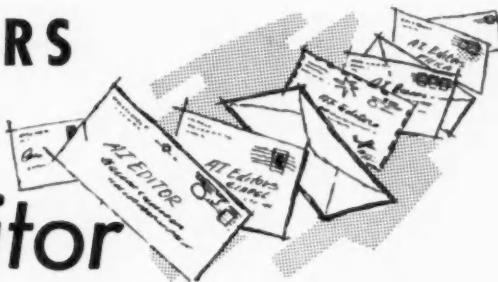


TUNE IN: Texaco Huntley Brinkley Report, Mon.-Fri.—NBC-TV



LUBRICATION IS A MAJOR FACTOR IN COST CONTROL (PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

LETTERS to the Editor



Readers' opinions or requests for additional information on material appearing in the editorial pages of AUTOMOTIVE INDUSTRIES are invited for this column. No unsigned letters will be considered, but names will be withheld on request. Address Letters to the Editor, AUTOMOTIVE INDUSTRIES, 56th & Chestnut Sts., Philadelphia 39, Pa.

AIR CONDITIONING

In a recent issue of AUTOMOTIVE INDUSTRIES you had an inquiry pertaining to car air conditioning. Inasmuch as air conditioning has become almost a necessity in certain areas of the United States, I am trying to obtain information as to brand names and models, and information as to the original cost and the possibility or feasibility of transferring the unit from one car to another. I would also appreciate knowing whether or not you have information as to what fleet operators are doing with regard to this accessory.

R. P. O'Connell
Fleet Manager
S. C. Johnson & Son, Inc.
Racine, Wis.

• *The forthcoming Products Guide Issue of AUTOMOTIVE INDUSTRIES (December 15), will list the makers of air conditioning units for cars and trucks, together with a list of manufacturers of parts for air conditioning units—Ed.*

AUTOMOBILES

The Chilton Co. recently published a book by Dr. John B. Rae, the title of which I believe, is "American Automobile Manufacturers—the First 40 Years." I would like two copies of this book.

Would you please arrange to have two copies sent to me, and also bill my office?

Errol J. Gay
Technical Consultant
1019 Fisher Bldg.
Detroit 2, Michigan

• *Copies have been sent.—Ed.*

VEHICLE IDEAS WANTED

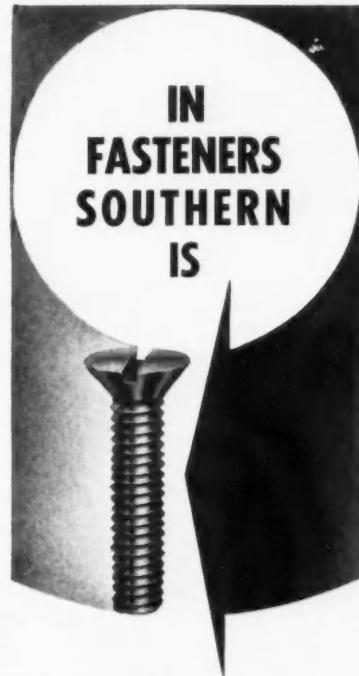
This Division is a comparatively recent addition to the Ford Motor Co. activities. The nature of our program and the circumstances surrounding it make it highly probable that we will select some new and novel ideas for application to our vehicles. An idea that develops into a standard equipment item would attain an annual volume of several hundred thousand; one that becomes an accessory or optional item would naturally attain a lesser volume.

With this thought in mind, we would like to express to you our broad interest in new ideas, applications, materials and processes. We would welcome the opportunity to discuss with you any new products or new ideas which you may have for application to or under consideration for automotive vehicles. Our primary interests are in those items that add safety, performance, comfort, beauty and prestige to the automobile.

In submitting any proposal for our consideration, please do not submit any material that you consider confidential, as our Company's policy will not permit us to consider ideas that are submitted in confidence.

Joe R. Gillette
Project Planning Office
M-E-L Division
Ford Motor Co.
3000 Schaefer Rd.
Dearborn, Mich.

• *Any suggestion, readers?—
Ed.*



completeness

Completeness at Southern Screw starts with the placing of your order and continues through the shipment of your screws on free disposable pallets. Whether your screws are supplied from stock or manufactured to your specifications, customers know that Southern Screw's **completeness** includes the consistent and constant quality and service they have a right to expect. Your fastener requirements really may call for "specials" which are standard in Southern Screw's 1,500,000,000-piece stock.

Let Southern demonstrate what **completeness** means on your next fastener requirement.

Machine Screws & Nuts • Wood Screws
• Tapping Screws • Stove Bolts •
Drive Screws • Hanger Bolts • Carriage Bolts • Dowel Screws

Manufacturing and Main Stock
in Statesville, North Carolina

Warehouses:
New York • Chicago • Dallas • Los Angeles



Circle 112 on Inquiry Card for more data

KNOW YOUR ALLOY STEELS . . .

This is one of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

How Heat-Treatment Affects Alloy Steels

Heat-treatment may be defined as an operation or series of operations involving the heating and cooling of steel in the solid state to develop the required properties. There are in general five different forms of heat-treatment used with alloy steel. These treatments modify the mechanical properties of the steel to suit the end use.

The five forms of treatment mentioned above, as applied to constructional alloy steels, are discussed in the following paragraphs:

(1) *Quenching and Tempering.* This form of heat-treatment usually consists of three successive operations: (a) heating the steel above the critical range, so that it approaches a uniform solid solution; (b) hardening the steel by quenching it in oil, water, brine, or salt; and (c) tempering the steel by reheating it to a point below the critical range in order to effect the proper combination of strength and ductility.

(2) *Normalizing.* A form of treatment in which the steel is heated to a predetermined temperature above the critical range, after which it is cooled to below the range in still air. The purpose of normalizing is to promote uniformity of structure and to alter mechanical properties.

(3) *Annealing.* This method consists of heating the steel to a point at or near the critical range, then cooling at a predetermined slow rate. Annealing is used to soften the steel, to improve machinability, to reduce stresses, to

improve or restore ductility, and to modify other properties.

(4) *Spheroidize-Annealing.* This form of heat-treating requires prolonged heating of steel at an appropriate temperature, followed by slow cooling to produce a globular condition of the carbide. This treatment produces a structure which may be desirable for machining, cold-forming, or cold-drawing, or for the effect it will have on subsequent heat-treatment.

(5) *Stress-Relieving.* This is the process of reducing internal stresses by heating the steel to a temperature below the critical range, and holding for a time interval sufficient to equalize the temperature throughout the piece. The object of this treatment is to restore the elastic properties of the steel, or to reduce stresses that may have been induced by machining, cold-working, or welding.

Each of the five forms of heat-treatment will be the subject of a future advertisement.

Bethlehem metallurgists have had long experience in all methods of heat-treatment. They understand the possibilities and limitations of each method with respect to various alloy steels. These men will be glad to help you with any problems concerning heat-treatment. Feel free to ask for their services.

And call on Bethlehem, too, for the full range of AISI standard alloy steels, as well as special-analysis steels and all carbon grades. We can meet your needs promptly.

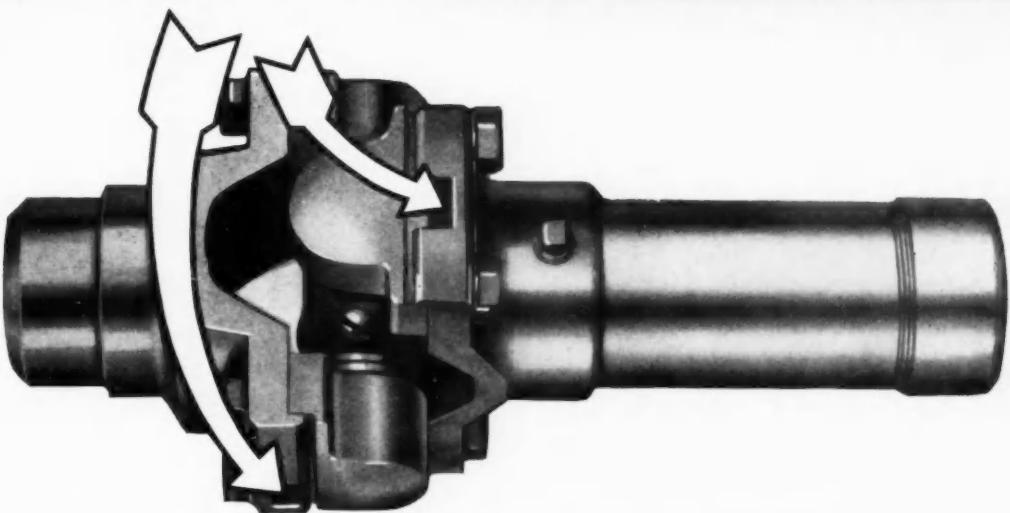
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



For SAFETY
Drive Through
KEYS

NOT Through
BOLTS Nor
SCREWS



Strong KEYS on the bearings—and corresponding KEYWAYS in the flanges—accurately machined from solid metal, transmit the torque in this largest capacity MECHANICS Roller Bearing UNIVERSAL JOINT. Two cap screws hold each bearing securely in place—their only function—and are locked in position. This KEY method of driving has the highest safety factor, transmits the most torque with the least weight, and

avoids costly breakdowns resulting from driving through bolts or screws that wear loose and shear off.

Let our engineers show you how this exclusive MECHANICS Roller Bearing UNIVERSAL JOINT advantage will help improve the operation of your product.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner • 2024 Harrison Ave., Rockford, Ill.
Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

MECHANICS Roller Bearing UNIVERSAL JOINTS

For Cars • Trucks • Tractors • Farm Implements • Road Machinery •
Aircraft • Tanks • Busses and Industrial Equipment

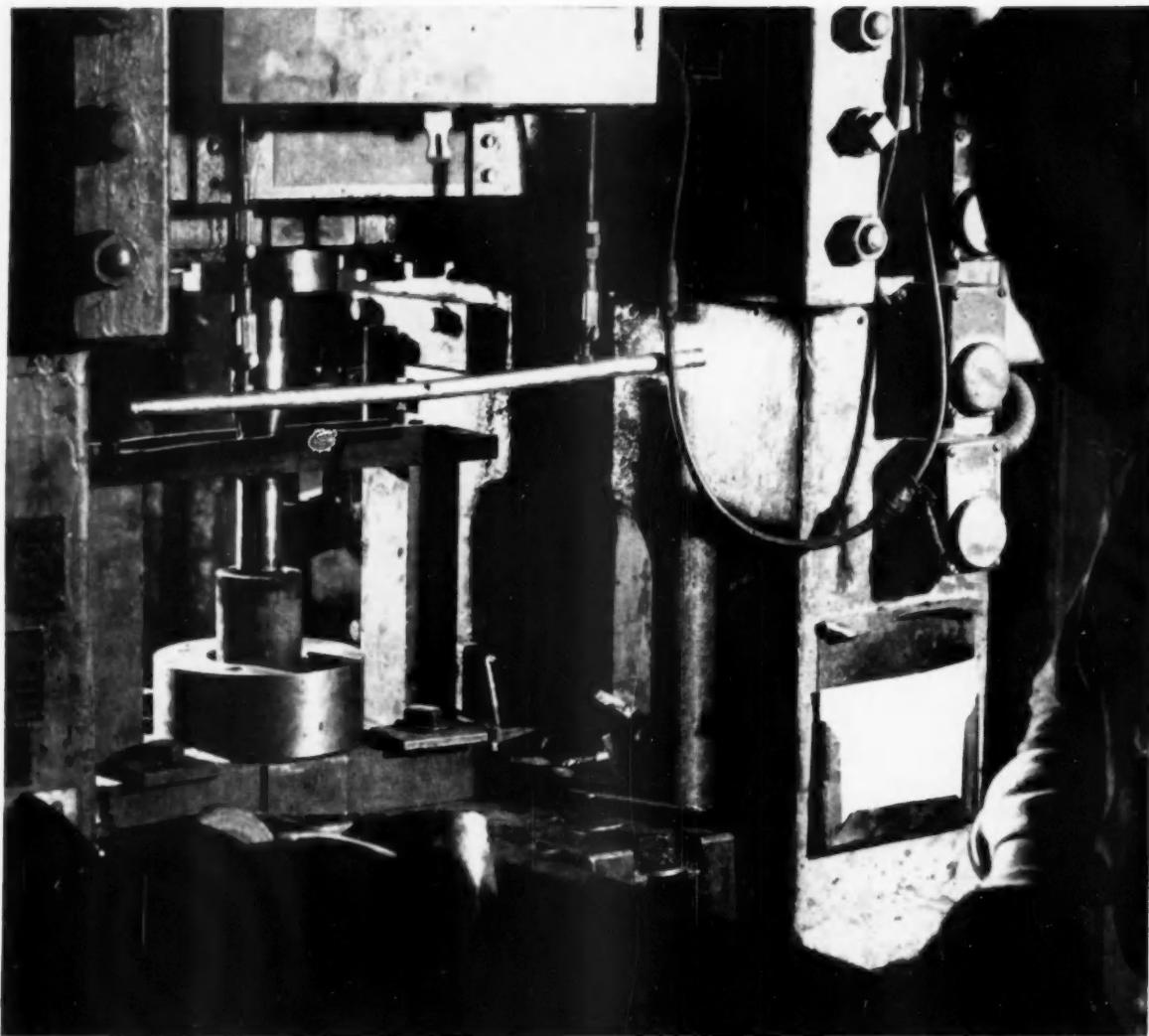


Photo courtesy of Heintz Division, Kelsey Hayes Company

HIGH PRODUCTION cold extruding **proof of Aristoloy uniform quality**

High-speed production of cold extruded parts like this track link bushing for a midwest equipment manufacturer can not tolerate variations in quality. Physical and chemical uniformity are all-important if costs are to be kept in line and rejects eliminated.

Aristoloy 8620 electric furnace steel meets the high quality requirements of Heintz Division of Kelsey Hayes Company and its customers.

From the melt shop to rolling and finishing operations, careful control guarantees that delivered bars will meet the most rigid standards of quality.

For complete information about Aristoloy leaded or standard carbon, alloy and stainless grades, call the Copperweld representative in your nearest large city. Or write today for NEW PRODUCTS & FACILITIES CATALOG.



COPPERWELD STEEL COMPANY

ARISTOLOY STEEL DIVISION • 4025 Mahoning Ave., Warren, Ohio • EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N. Y.

NEWS

Vol. 121, No. 11

December 1, 1959

Ford Gets New Look

All Assembly Plants Placed under Ford Div.

Ford Motor Co. has centralized all assembly plant operations under Ford Div., stripping Lincoln-Mercury Div. (formerly M-E-L) of any responsibility in this field.

Thus the Lincoln plant at Wixom, Mich., and the three Mercury plants at Wayne, Mich., Metuchen, N. J., and St. Louis, Mo., are under the jurisdiction of W. A. Folsom, general manufacturing manager of Ford Div. D. J. Bracken, formerly with the old M-E-L Div., becomes assistant general manufacturing manager.

Buying Also Combined

The move also combines purchasing activities of both divisions under C. E. Bosworth, general purchasing agent of Ford Div.

Although the assembly plants come under Ford divisional supervision, the new set-up resembles the Chrysler organization, where all manufacturing and assembly functions are removed from the passenger car divisions.

Lincoln-Mercury Div. thus becomes purely a marketing organization, similar in structure to Plymouth-De Soto-Valiant Div. It is charged with sales, advertising, market research, product planning and engineering, dealer relations, service, etc. Lincoln-Mercury con-

tinues as the imported car agent in the U. S., distributing German and English Ford products.

Change Was Expected

The change was not unexpected. For several years there has been much criss-crossing of divisional lines in Ford's assembly operations. And product changes in the coming year would further complicate the picture.

M-E-L Div., for example, had been building the Ford Thunderbird at the Wixom Lincoln plant. Edsel, before its demise, was built in the Ford Div. Louisville plant. Ford also built Mercury cars in the Ford Los Angeles plant.

Body and power train manufacturing already are line group functions with no connection to either Ford or Lincoln-Mercury Divisions. These two groups take care of nearly all basic manufacturing for both passenger car divisions.

Ford Div. operates only two plants, besides its assembly plants and its small pilot assembly plant in Allen Park, Mich. These are the Highland Park trim plant and the service sheet metal plant in the Rouge, both near Detroit.

All other manufacturing comes



W. A. Folsom heads all Ford assembly operations

under the power train group or the body group. The power train group has two divisions, transmission and chassis division and engine and foundry. The body group breaks down into four divisions—metal stampings, steel, glass and hardware and accessories.

Assembly Operation Split Off

So the next step would seem to be divorcing assembly operations from Ford Div. and placing them directly under Car and Truck group vice president Robert McNamara.

DAIMLER V-8 BOWS



First showing of the production model of Daimler V-8 sports car took place in New York City recently. Car has reinforced fiberglass body and is powered by a 152.5-cu ft V-8 engine rated 140 bhp at 5800 rpm. Wheelbase is 92 in., overall length 160.5 in., and weight 2218 lb. Car will sell for \$3702 at East Coast ports of entry.

As it is McNamara controls assembly plants, but through Ford Div. management.

One of the first changes to come through under the new setup is the conversion of the Metuchen plant to compact car production, and the boosting of Mercury output at Wayne and St. Louis.

Both the Comet and the Falcon will be built at Metuchen when the change is completed. This will give Falcon three assembly points, including San Jose, Calif., Lorain, O., and Kansas City.

Mercury output will be increased 90 per cent at St. Louis and 40 per cent at Wayne to make up for the Metuchen output lost in the conversion.

S-P Continues Talks With Oliver

Studebaker-Packard Corp. is continuing closed-door negotiations for the acquisition of Oliver Corp.'s farm implement business. Harold E. Churchill, Studebaker president, confirmed reports that talks were under way, but no more.

Oliver's farm equipment business for the first nine months of 1959 totaled more than \$55 million. According to reports, a cash-and-stock transaction would give S-P four Oliver plants in the Midwest.

The acquisition, which would be subject to stockholder approval,

would be the third for Studebaker. Earlier this year the auto maker bought Gering Plastics Company and C-T-L, another plastics firm. Further acquisitions are anticipated under S-P's current program.

Car Output to Pick Up In December

Passenger car assembly will resume December 7 at the Cadillac plant in Detroit, and at the Chevrolet plants at Willow Run and Flint, Mich., Norwood, O. and Janesville, Wis.

GM president John F. Gordon says these plants will be able to operate four days that week. Assembly at all other GM car and truck divisions will start up again Monday, December 14.

GM began recalling workers in mid-November, but assembly was not resumed until December, because parts supplies had to be replenished.

Chrysler Corp., meanwhile, was feeling the delayed effects of the steel strike. Three Chrysler Corp. assembly plants were forced to close on November 24 for lack of steel.

Ford, AMC, and S-P finished November without shutdowns.

Plymouth Detroit and St. Louis plants will shut down December 1 and Chrysler Jefferson plant in Detroit on December 2. Chrysler

assembly operations will begin again December 9 at some of the Detroit area plants, with the balance of assembly plants beginning operations shortly thereafter.

Layoffs at Chrysler will total 38,000, including the three December shutdowns.

Clark Buys West German Firm

Clark Equipment Co. has taken over W. & J. Scheid, a West German manufacturer of road rollers, compactors and other road repair equipment. The firm has been reorganized as Scheid Maschinenfabrik GmbH, and expansion of the 170,000 sq ft plant already is under way to allow room for Clark's Michigan line of construction equipment. The acquisition was made through Clark Equipment International and Ruhr Intrans Hubs-Tapler GmbH, Clark's German licensee.

Gar Wood Builds New Forest Vehicle

Gar Wood Industries, Inc., has developed a versatile new vehicle designed for earth-moving, fire fighting, planting, spraying and a host of other operations.

Called the Buschmaster, it is described as the "world's first fully integrated forest management vehicle." The rubber-tired four-wheel-drive unit is equipped with a self-contained water system, fire plow and winch, hydraulically operated bulldozer blade and grading blade, and draw bar for scrapers, planters and other attachments.

The Buschmaster is powered with a 100-hp Diesel engine and hydraulic steering. The two-piece oscillating chassis permits the vehicle to take rugged terrain and steep grades.

Gar Wood is building the Buschmaster in Wayne, Mich., for Timberline Equipment Company of Bradley, Ill.

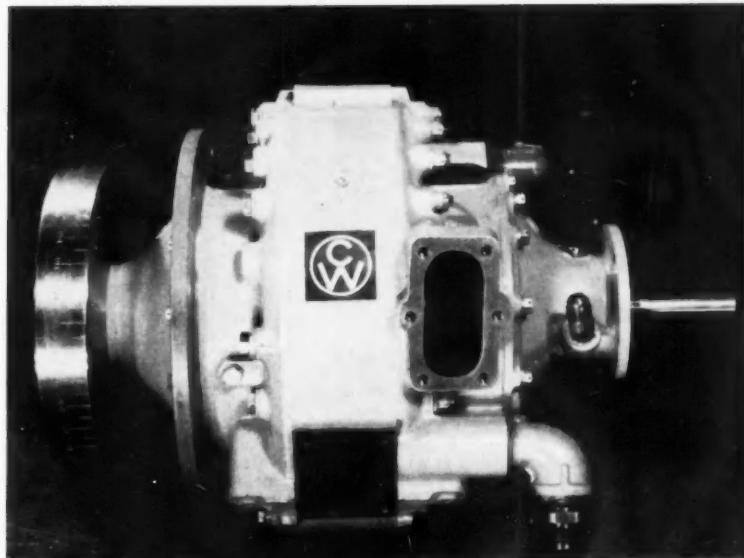
Comet to Get Bigger Falcon Engine

Ford Motor Co. has lengthened the stroke of its six-cylinder Falcon engine for application in the new Lincoln-Mercury Div. compact Comet.

The Comet engine, which will deliver 95 hp, will have a bore of 3.5 (same as Falcon) and a stroke of 2.94 in. This is 0.44 in. longer than the Falcon stroke.

The longer stroke will mean a displacement of 170 cu in., compared with the Falcon's 144 cu in. Compression ratio may be increased, although the possibility of retaining the 8.7 to 1 ratio still is under study.

Ford has abandoned an earlier proposal for beefing up the 144-in. engine with changes in cam and carburetion.



New Curtiss-Wright engine has only two moving parts

Curtiss-Wright Has Engine with Only 2 Moving Parts

A lightweight internal combustion engine with only two moving parts was unveiled by Curtiss-Wright Corp.

The radical power plant, developed jointly by Curtiss-Wright and NSU Werke of Germany, is slated to go into production next year, with models ranging from 100 hp to 700 hp.

Roy T. Hurley, chairman and president of Curtiss-Wright, said the new unit, which he described as a "rotating" combustion engine, combines the best features of the piston and jet engines. He asserted that it would "set new standards for internal combustion performance."

The engine consists of a triangular rotor mounted on a crankshaft in a four-sided combustion chamber. A carburetor similar to that on a conventional spark ignition engine supplies a mixture of gasoline and air to the engine

through a side wall port. As the rotor turns, the mixture is compressed between one side of the rotor and the chamber wall and ignited by a single spark plug. The burning gas expands, providing power to the rotor. Exhaust gases are vented through a port in the lower wall of the chamber.

There are three such power sequences for each revolution of the crankshaft, maintaining an almost continuous intake, compression, ignition, expansion, and exhaust cycle. For this reason and because there are only two moving parts vibration is at a minimum and the noise level is low.

Mr. Hurley said the new engine would be available for cars, boats, airplanes, and many industrial uses. Because of its simplicity and the absence of "exotic" materials, he said, it would be priced competitively with other powerplants.

Mr. Hurley said that Curtiss-

Wright is working on units in the high horsepower class, while NSU will continue to develop units in the low horsepower range. Curtiss-Wright, he added, has exclusive rights to the engine for aircraft uses throughout the world, with exclusive rights for all other purposes in the U. S., Canada, and Mexico. NSU will be able to ship the engine to North America only when it is installed in their own cars, motorcycles and scooters.

GM Shifts Monaghan

Philip J. Monaghan, a vice-president of General Motors and head of GMC Truck and Coach Div., has been appointed head of the GM Process Development Staff. He replaces Robert M. Critchfield, who is retiring.

C. J. Werner, general manager of Moraine Products Div., becomes general manager of GMC Truck and Coach Div., and N. L. Gebhart moves up from manufacturing manager to general manager at Moraine Products Div.

NEWS

CONTINUED

FIAT CONVERTIBLES



Fiat two-passenger convertible is available in two models—the 1500 and 1200. The 1500 is powered by a four-cylinder 80 hp engine with a compression ratio of 8.6 to 1. Engine of the 1200 is rated at 58 hp and has a compression ratio of 8.25 to 1. Both models are built on a 92-in. wheelbase and are of unitized construction.

Ford Drops Edsel Line After 2 Lean Years

Ford Motor Co. officially discontinued the Edsel Nov. 19, just three years to the day from its untimely launching.

Ford said retail sales of 1960 Edsel were "particularly disappointing." Actually, Edsel sales were disappointing right from the start. Production during the car's brief life span totaled only 110,000 units.

It was on November 19, 1956, that Ford's Special Products Div. was renamed Edsel Div., and the experimental "E" car was officially designated Edsel after Henry Ford's only son. The car, bearing an overall development price tag of \$250 million, was introduced to the public Sept. 4, 1957.

But the timing was bad. When Ford began studies a decade earlier on the market for a medium-priced car, the potential seemed good. The Korean War, however, delayed plans, and by the time Edsel made its bow, the medium-price market was declining.

End Was Expected

Edsel's end was not unexpected, although it came a little earlier than most observers predicted (see AI Aug. 15, p. 37). Edsel, in fact, did not have time to cancel a full-page advertisement in a national consumer magazine, which broke after the announcement that the line was being discontinued.

The M-E-L Div. reverts to Lincoln-Mercury Div., the same name it carried until April of 1955. That was when Lincoln and Mercury were split into separate divisions, and the Special Products Div., under Richard E. Krafve, was formed. This later became Edsel Div.

Then, in August of 1957, the Lincoln and Mercury Div. was formed. Edsel joined this group in January, 1958, when the M-E-L div. was set up. This was the first step in Edsel's loss of identity.

Production Slashed

At the end, Edsel was being built only at the Ford Div. Louis-

ville plant, and production was down to a trickle. The 1960 Edsel, for all practical purposes, was merely a Ford with distinctive grille and trim. Only six models were offered from 1960, a far cry from the original 18 models in four body styles.

At first, Edsel was planned to bracket the medium-priced field, covering some models of Ford and completely blanketing Pontiac and Dodge, plus low-end De Soto, Chrysler, Buick, Oldsmobile and Mercury models. Production through the end of '57 totaled 50,393 units, but dropped to 28,953 in recession 1958.

This year production amounted to slightly more than 30,000 units. Ford's other lines—Ford, Mercury, Thunderbird, Lincoln, and imported cars—showed a 40 per cent increase over last year during the first third of November, while Edsel sales continued down.

Ford officials said the steel allocated to Edsel would be diverted to other passenger car production. It is not likely, however, that the steel strike itself influenced the decision to drop the car.

All but two Edsel dealers were dualed with Mercury, and they stand to get the compact Comet when it comes out in the spring to fill the new gap. Edsel dealers will get a rebate from Ford Motor Co. for any Edsels sold after Nov. 19. Purchasers of 1960 Edsels prior to that date will receive a \$300 credit toward the purchase of another Ford product.

Chrysler in Hawaii

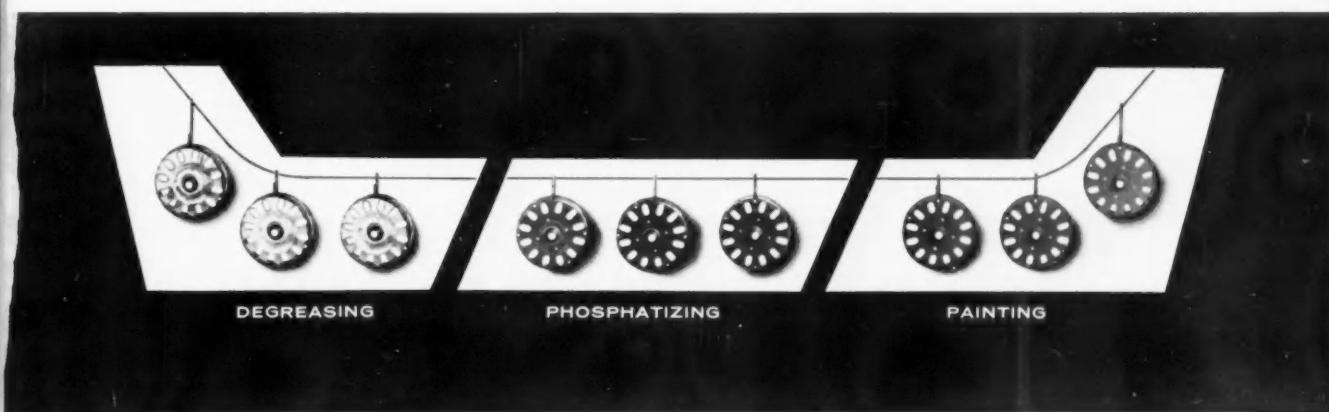
Chrysler Corp. has heeded the call of the Islands.

E. C. Quinn, vice president-sales divisions, says the corporation has "raised its sights" and expects to sell 25 to 30 per cent more cars in Hawaii in 1960 than it did last year.

Chrysler's products went on sale in Hawaiian dealerships Nov. 5 and 7, following special showings in Honolulu. Quinn says that the ratio of one vehicle for every three Hawaiians will increase as business and industry expand on the Islands.

DU PONT
ANNOUNCES

“TRICLENE”
TRICHLORETHYLENE
FINISHING



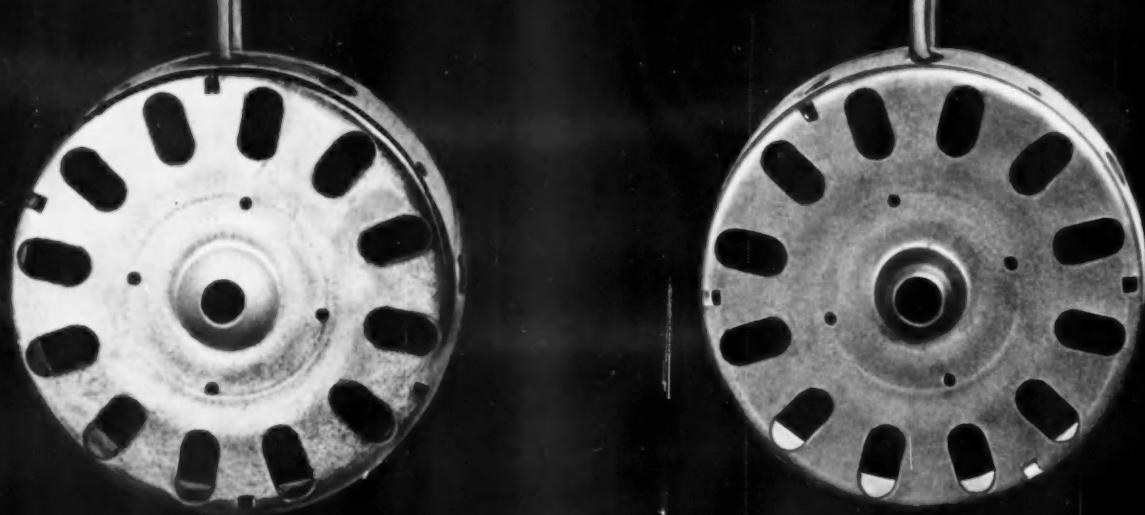
*A revolutionary new way to finish metals...
based on Du Pont “Triclene” trichlorethylene*



“Triclene” is Du Pont's registered trademark for its trichlorethylene.

Now it is possible to ...

CLEAN → PHOSPHATIZE



The production part (shown above) was cleaned, phosphatized and painted in a "Triclene" Finishing unit built by *G. S. Blakeslee & Co.*, Chicago, Ill.

Du Pont "Triclene"® Finishing provides a new, safer way to finish metals—at substantially lower cost!

It cuts overall costs

Low Investment—"Triclene" Finishing cuts equipment cost up to 50% below conventional finishing methods. Because it is an anhydrous system, parts emerge from cleaning and phosphatizing steps completely dry; the need for costly drying ovens is eliminated. The "Triclene" Painting step also eliminates drying ovens and drip pans normally required following conventional painting. Fewer steps mean that in-process parts inventory and conveyor length can be reduced up to 55%.

Low Operating Costs—"Triclene" Finishing can cut operating costs up to 30%. Reason: It permits close to 100% recovery of paint overspray and excess solvent for reuse. Because "Triclene" Finishing is an anhydrous system, heat requirements are drastically reduced.

Reduced Plant Space—"Triclene" Finishing can be done in less than $\frac{1}{2}$ the space because fewer steps are required. For example: a conventional wet cleaning, phosphatizing and dip-painting system requiring 1960 square feet of floor space could be replaced with a "Triclene" Finishing System requiring only 695 sq. ft.

It increases safety

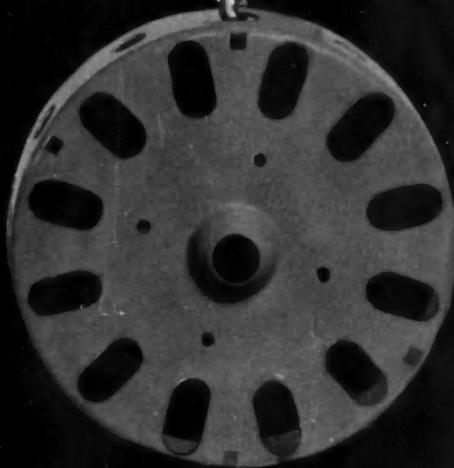
Nonflammable—Trichlorethylene is rated by Underwriters' Laboratories as nonflammable at ordinary room temperatures. Thus fire and explosion hazards are minimized. This means greater plant safety, lower insurance rates and reduced investment in fire protection equipment.

It is flexible

The complete Du Pont "Triclene" Finishing System consists of three basic trichlorethylene-based processes: Vapor Degreasing, Phosphatizing and Painting (see booklet). They can be used in various combinations or incorporated singly into your present finishing system. Various dip or spray cycles can be selected for each of the processes. Both large and small finishing operations can utilize "Triclene" Finishing Processes.

For more detailed information please read the enclosed booklet showing examples of three possible "Triclene" Finishing Systems.

→PAINT *continuously...*



in a single
medium of
nonflammable
Triclene®
trichlorethylene

more information

Here are the facts on

3 basic Triclene® Finishing Systems

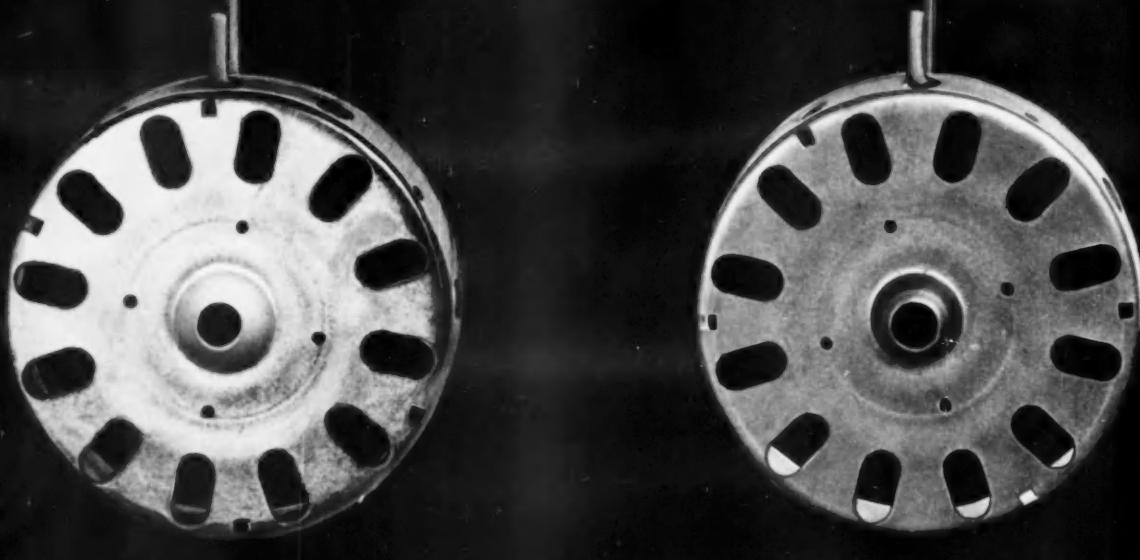
Integrated vapor degreasing and nonflammable painting

Vapor degreasing and dry phosphatizing

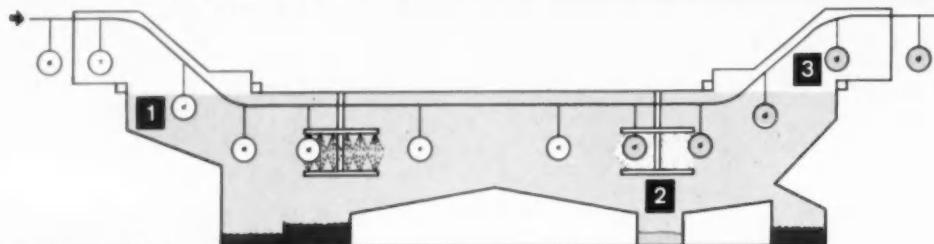
Vapor degreasing, dry phosphatizing and nonflammable painting

Now it is possible to...

CLEAN → PHOSPHATIZE



Du Pont "Triclene"® Finishing System #1



INTEGRATED vapor degreasing and nonflammable painting

The first "Triclene" Finishing System — announced by Du Pont last year — made it possible to integrate cleaning and painting in one compact unit.

HERE'S HOW IT WORKS:

1. A soiled metal part enters the degreasing section of the unit (above) where it is quickly and thoroughly cleaned by trichlorethylene vapor-spray-vapor degreasing.

2. The part moves into the painting section where a new type of industrial paint, thinned solely with nonflammable "Triclene" Paint Grade trichlorethylene, is applied. Spray-In-Vapor method is illustrated; dip painting is also available.

3. The hot, painted part emerges from the unit. Excess solvent quickly evaporates, leaving part completely dry (when lacquers are used), or ready for a short baking step (when curing paints are used).

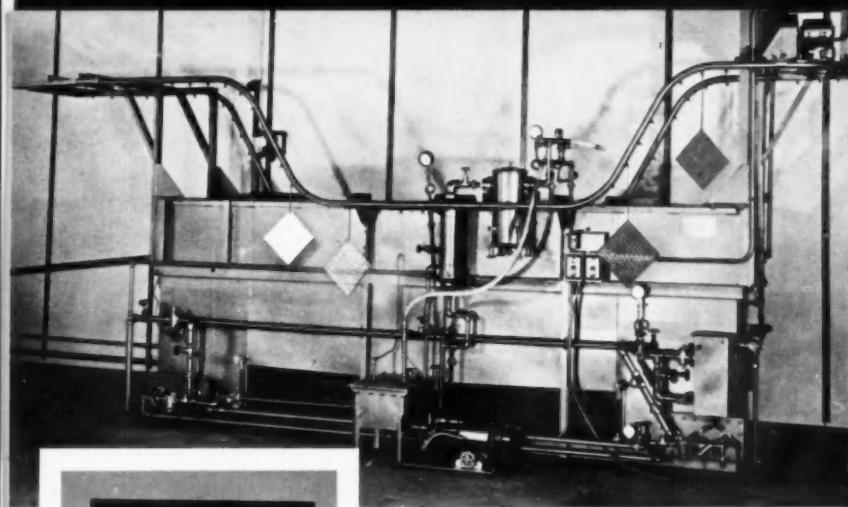
ADVANTAGES — Integration of cleaning and painting in a single unit drastically reduces equipment size; does away with drip pans; and eliminates the need for a dry-off oven. It also permits close to 100% recovery of paint over-spray and excess solvent for reuse. The amount of "Triclene" solvent recovered from the painting phase will often be enough to run the entire degreasing operation! Nonflammability means greater plant safety, lower insurance rates and less investment for fire protection equipment. These advantages result in substantial cost savings as shown in the comparison at right.

PRESENT STAGE OF DEVELOPMENT — The "Triclene" vapor degreasing and painting system is ready now for general commercial use. A variety of high-quality industrial paints based on "Triclene" trichlorethylene is available. Arrangements can be made to test-paint your parts in demonstration units. (See postcard on back cover.)

→PAINT *continuously...*



in a single
medium of
nonflammable
Triclene®
trichlorethylene



Demonstration unit for Degreasing/Spray-In-Vapor Painting now in operation at G. S. Blakeslee & Co., Chicago.

This "Lawn King" lawn-spreader is now being dip painted commercially using an air-dry "Triclene" thinned paint.

QUALITY OF WORK—Production experience shows excellent appearance and uniformity of film thickness—even on complex parts. Generally, results are equivalent or superior to those obtainable with conventional dip or flow-coat processes.

COMPARE TOTAL COSTS

EXAMPLE:

Work: Steel Shelves
Area Painted: 4,200 sq. ft./hr.

CONVENTIONAL METHOD

Alkali washing, dip
painting, oven drying
steps.

Total Finishing Cost
\$48.40/hr

Total Investment Cost
\$169,000
(Approx. Equipment
Cost—\$61,000)

Total Operating Area,
Sq. Ft. **1,640**

"TRICLENE" FINISHING

Integrated "Triclene"
Degreasing and
Spray-In-Vapor Paint-
ing System.

Total Finishing Cost
\$38.00/hr

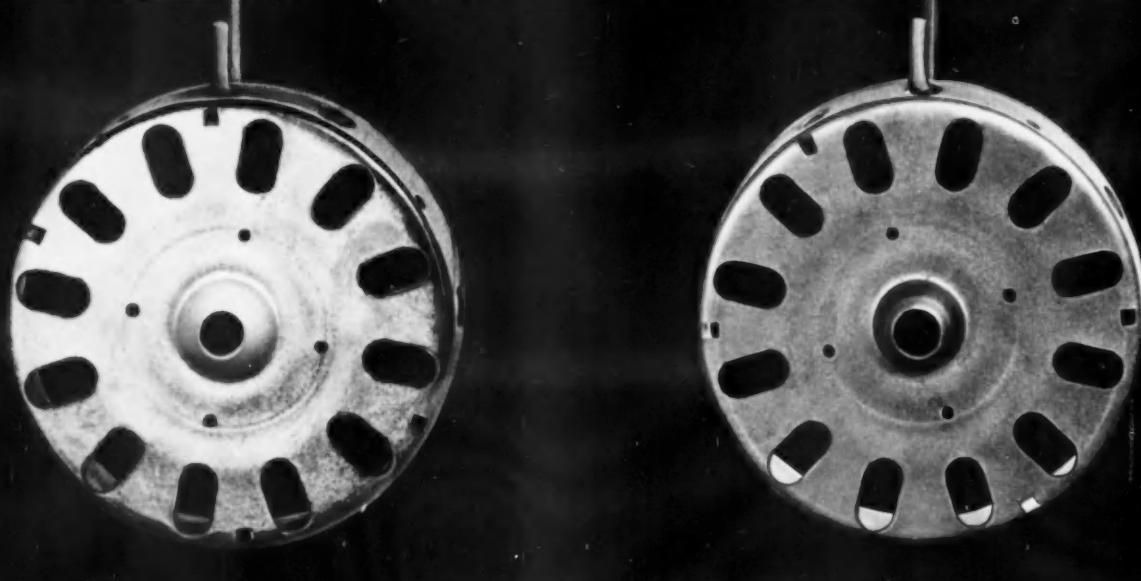
Total Investment Cost
\$94,000
(Approx. Equipment
Cost—\$30,000)

Total Operating Area,
Sq. Ft. **480**

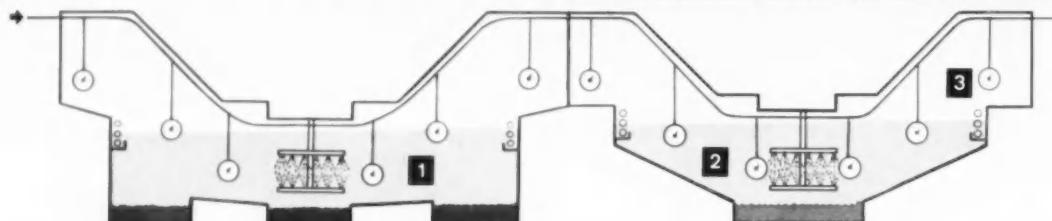
If you're planning to expand or modernize your operation, consider all of the advantages of a "Triclene" Cleaning and Painting System. Du Pont will be glad to help you make a comparative Cost Analysis and to evaluate "Triclene" Finishing for your needs. Fill out postcard on the back page.

Now it is possible to...

CLEAN → PHOSPHATIZE



Du Pont "Triclene"® Finishing System #2



Vapor degreasing and phosphatizing

PRESENT STAGE OF DEVELOPMENT—

After years of research, Du Pont has developed a new anhydrous phosphatizing method based on trichlorethylene. This recently announced development now makes possible linking of the "Triclene" Degreasing and Painting Processes with a compatible anhydrous phosphatizing process.

Although there are two successful full-scale test installa-

tions now in operation, "Triclene" Phosphatizing will not be commercially available until mid-1960. This will permit Du Pont to complete extensive field testing of the process. Those who wish to explore the possibility of participation in the field test program, or who wish to plan for future modernization, can evaluate "Triclene" Phosphatizing now.

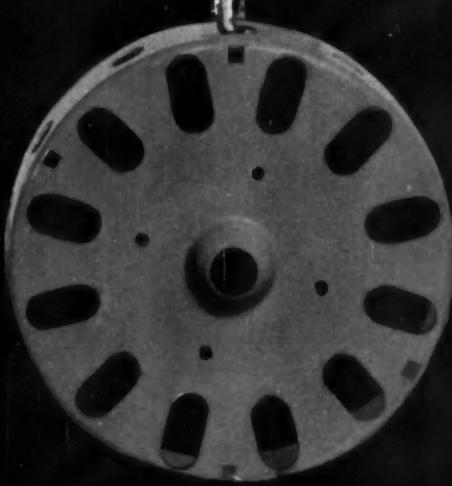
This "Triclene" System combines vapor degreasing and dry phosphatizing; requires just two compact units.

HERE'S HOW IT WORKS: A soiled metal part enters the two-stage system (No. 1 above) where it is thoroughly cleaned by trichlorethylene vapor-spray-vapor degreasing. The part then enters the phosphatizing stage (2) where it is treated in the anhydrous phosphatizing composition. When the phosphatized part emerges from the trichlorethylene

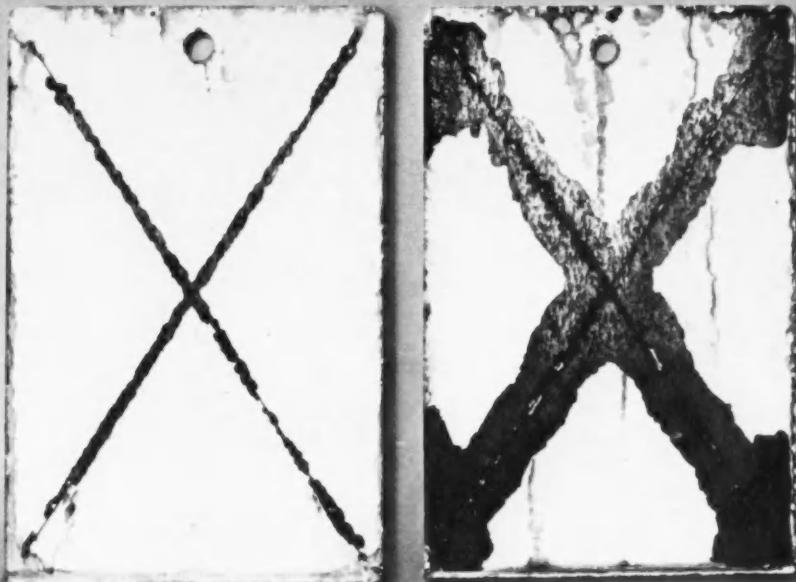
vapor (3) the solvent evaporates and the part is completely dry and ready for "Triclene" Painting, conventional painting, or in-plant storage or shipping.

ADVANTAGES: Anhydrous "Triclene" Degreasing/Phosphatizing takes as little as one-half the time and space of conventional wet systems. Heat requirements are reduced sharply and no dry-off step is needed prior to painting. These advantages result in substantial cost savings as shown in the comparison at right.

→PAINT continuously...



in a single
medium of
nonflammable
Triclene®
trichlorethylene



Standard salt-spray exposure test shows quality of "Triclene" phosphatizing: The steel panel on the left was cleaned and phosphatized in a "Triclene" Finishing System and compared with unphosphatized-painted steel after standard salt-spray exposure for 600 hours. As indicated by the minimum corrosion at the scribe mark, the "Triclene" Phosphatized panel shows significantly improved finish performance.

QUALITY OF WORK—"Triclene" Phosphatizing produces an adherent phosphate conversion coating with improved corrosion resistance. In addition, the phosphate coating alone is remarkably resistant to rusting. This unique property benefits the steel fabricator who wishes to store or ship his parts prior to painting.

COMPARE TOTAL COSTS

EXAMPLE:
Work: Steel Shelves
Area Painted: 4,200 sq. ft./hr.

CONVENTIONAL METHOD

Alkali washing, "wet"
phosphatizing, oven
drying steps.

Total Cleaning/
Phosphatizing
Cost \$12.00/hr

Total Investment
Cost \$73,600
(Approx. Equipment
Cost—\$33,000)

Total Operating Area,
Sq. Ft. 760

"TRICLENE"® FINISHING

"Triclene" Degreas-
ing / Phosphatizing
System.

Total Cleaning/
Phosphatizing
Cost \$8.30/hr

Total Investment
Cost \$45,500*
(Approx. Equipment
Cost—\$27,000)

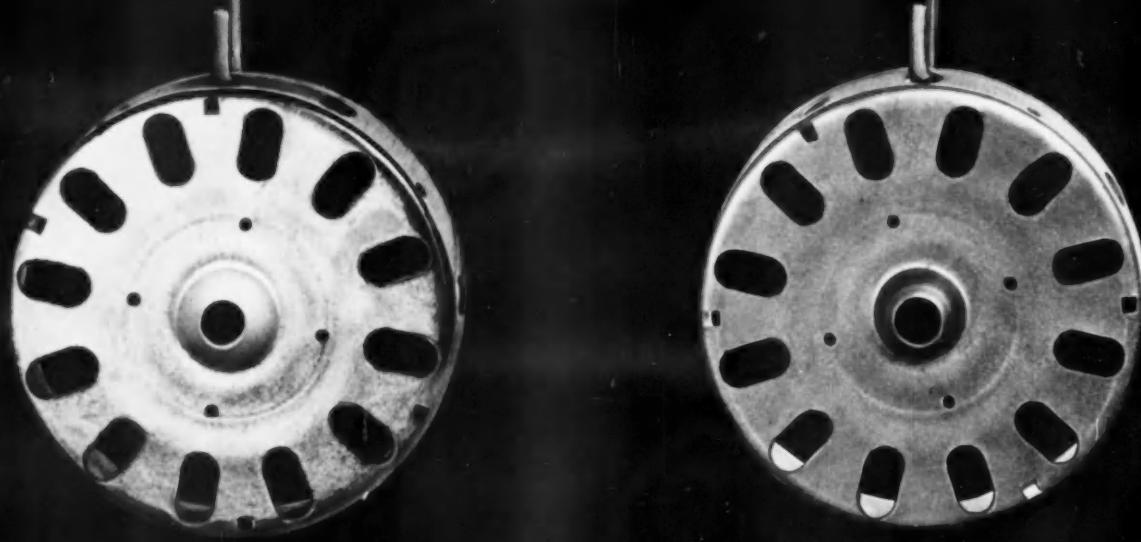
Total Operating Area,
Sq. Ft. 456

*The relative cost advantage for the high-production system illustrated is also attainable with smaller operations.

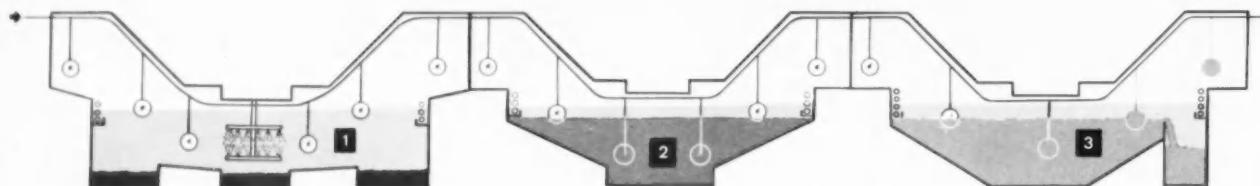
If you're planning to expand or modernize your operation, Du Pont will be glad to help you make a comparative Cost Analysis and to evaluate "Triclene" Degreas- and Phosphatizing for your needs. Fill out postcard on the back page.

Now it is possible to ...

CLEAN → PHOSPHATIZE



Du Pont "Triclene"® Finishing System #3



Vapor degreasing, phosphatizing* and painting

This is the complete "Triclene" Metal Finishing System—the ultimate in processing efficiency.

HERE'S HOW IT WORKS: A soiled metal part enters this three-stage unit (above) and is: (1) thoroughly cleaned by trichlorethylene vapor-spray-vapor degreasing . . . (2) phosphatized during one short immersion in the phosphatizing solution . . . (3) dip painted with "Triclene" Paint Grade trichlorethylene thinned paint. Finished part emerges from the unit completely dry when lacquer is used or ready for a short baking step in the case of curing paints. (Spray-In-Vapor painting, not shown, is available.)

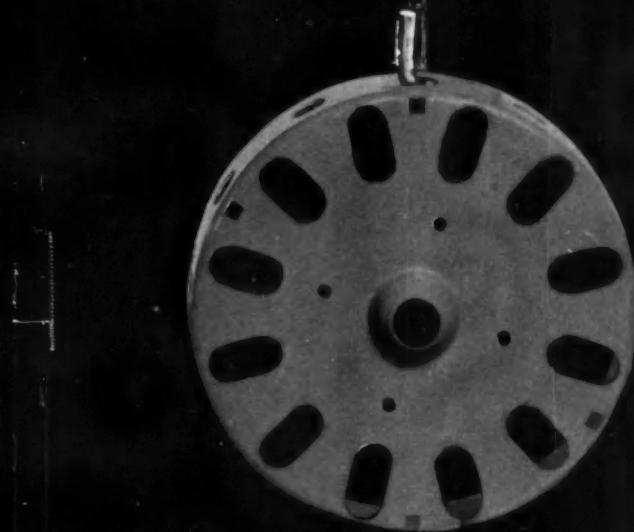
ADVANTAGES—The complete Du Pont "Triclene" Finishing System consists of three compact steps. (If baking enamels are used, a fourth but shortened baking step is required.) Conventional systems take up to 12 steps to do the same job. Nonflammable "Triclene" Finishing cuts in-

surance and fire protection costs—safeguards plant investment. The lower equipment costs and heat and floor space requirements all result in appreciable savings, as shown in the cost comparison at right.

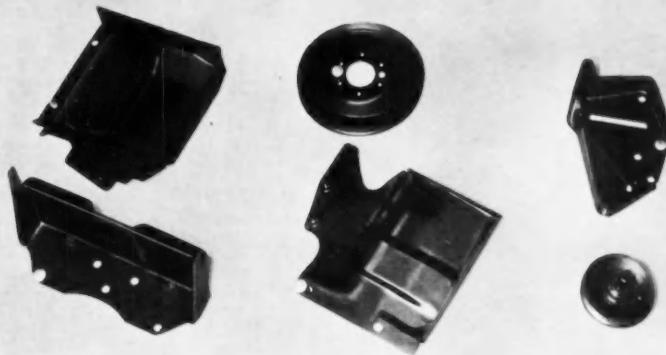
QUALITY OF WORK—Combining the "Triclene" Processes into one complete system produces a finish which exhibits improved adhesion and corrosion resistance, and excellent appearance.

***Present Stage of Development:** Although a large automotive manufacturer is now using the complete "Triclene" Finishing System, the phosphatizing stage will not be available for wide commercial use until mid-1960. This will permit Du Pont to complete field trials on the "Triclene" Phosphatizing Process. Those who wish to explore the possibility of participation in the Field Test Program, or who are planning future modernization, can evaluate "Triclene" Phosphatizing now. (Fill out postcard on back page.) As stated previously, "Triclene" Degreasing and Painting are commercially available now.

→PAINT continuously...



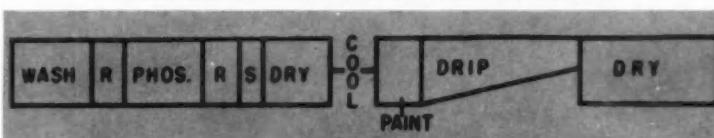
in a single
medium of
nonflammable
Triclene®
trichlorethylene



• These automobile engine production parts were vapor degreased, phosphatized and painted in a "Triclene" System similar to the one diagrammed at left.

Compare Operating Areas

CONVENTIONAL METHOD requires 1,960 sq. ft.



"TRICLENE" FINISHING requires 695 sq. ft.



COMPARE TOTAL COSTS

EXAMPLE:

Work: Steel Shelves
Area Painted: 4,200 sq. ft./hr.

CONVENTIONAL METHOD

Alkali washing, wet
phosphatizing, dip
painting, oven-drying
steps.

Total Finishing
Cost \$54.30/hr

Total Investment
Cost \$200,000
(Approx. Equipment
Cost—\$73,000)

Total Operating Area,
Sq. Ft. 1,960

"TRICLENE" FINISHING

Vapor degreasing,
phosphatizing,
painting.

Total Finishing
Cost \$41.70/hr

Total Investment
Cost \$122,000
(Approx. Equipment
Cost—\$42,000)

Total Operating Area,
Sq. Ft. 695

If you're planning to expand or
modernize your operation, con-
sider all of the advantages of a
complete "Triclene" Finishing
System. Du Pont will be glad to
help you make a comparative
Cost Analysis and to evaluate
"Triclene" Finishing for your
needs. Fill out postcard on the
back page.

Now it is possible to...

CLEAN → PHOSPHATIZE



**Here's what to do
if you are
interested in
evaluating
"TRICLENE"
FINISHING
for your operation**

Fill out and return the postcard at right. If you indicate a general interest, Du Pont will mail you technical literature describing the processes; if you indicate a specific or immediate need for evaluation, Du Pont will initiate the following evaluation program:

1 Finishing Analysis

Du Pont will provide you with detailed process literature and a Finishing Data Sheet which, when filled out by you, will give Du Pont the information needed to answer these three important questions:

1. Will "Triclene" Finishing maintain or improve your quality standards?
2. Is "Triclene" Finishing mechanically applicable in your particular case?
3. What cost advantage can you expect to realize from adoption of a "Triclene" Finishing System?

Preliminary answers to these questions will be presented in a complete Finishing Analysis which will include estimates of equipment size and cost plus a confidential "High-Spot" finishing cost comparison of the recommended "Triclene" System with the equivalent conventional system.

→PAINT continuously...



in a single
medium of
nonflammable
Triclene®
trichlorethylene

2 Product Evaluation and Equipment design

If Du Pont's Finishing Analysis shows that a "Triclene" Finishing System appears applicable to your particular operation, Du Pont will then make arrangements to supply you with panels and parts necessary for you to evaluate the finish produced by the "Triclene" System. Du Pont will then work with the paint and equipment manufacturers to translate laboratory-scale results into a well-designed full-scale system.

3 Help in Start-up

When you install equipment for "Triclene" Finishing you can count on Du Pont assistance through the important start-up period. Du Pont will work with you and your paint and equipment suppliers—will be glad to advise on installation, start-up and operating procedures.

4 Follow-through Service

You can obtain continuing Du Pont service after your "Triclene" System is in operation. A trained Du Pont representative will check with you regularly . . . and will be available when you need technical help.

Fill out this card and mail to Du Pont

I'm interested in evaluating DuPont "Triclene" Finishing for

CLEANING PHOSPHATIZING PAINTING

I would like technical literature describing these processes.

Our Company would consider replacement of existing equipment if we can be shown economic justification. Please send me your Finishing Data Sheet.

We have an immediate need for new finishing equipment to be installed by _____ (target date)

Please have your representative contact me.

Please fill out completely:

Describe parts you finish. _____

Type of process you now use for:

Metal cleaning. _____

Phosphatizing. _____

Painting. _____

Name. _____

Position. _____

Firm. _____

Address. _____

City. _____ Zone. _____ State. _____

DuPont makes two trichlorethylene products for use in "Triclene" vapor degreasing and painting

1. "Triclene" D Metal Degreasing Grade trichlorethylene—long recognized as the "standard of the industry". Its consistent high quality means top performance under all operating conditions. Reason: an exclusive combination of neutral stabilizers that resist deteriorating influences, thus assuring longer solvent life. "Triclene" D leaves parts bright and clean, free from deposits, staining, etching; keeps degreaser coils free of sludge; reduces costly downtime and maintenance. "Triclene" D is easily recoverable for reuse.

NOTE: Du Pont's "Triclene" Phosphatizing Grade trichlorethylene, which is now under field test, will be commercially available in mid-1960 when the phosphatizing process will be ready for general use.

Metal degreasing and paint grades of "Triclene" trichlorethylene are available now from any of these Du Pont distributors:

ARIZONA

Western Chemical & Mfg. Co.

CALIFORNIA

COLORADO

Braun-Knecht-Heimann Co.

CONNECTICUT

Crane Equipment & Supply Co.
Ethylene, Inc.

ILLINOIS

Hubbard-Hall Chem. Co.
Mac Cormick, Inc.

FLORIDA

Biscayne Chem. Labs, Inc.
Lenfesty Supply Co.

GEORGIA

McKesson & Robbins, Inc.

INDIANA

Central Solvents & Chems. Co.

ILLINOIS

Dico Corp., Ltd.

KANSAS

Industrial Oil & Chem. Co.

KENTUCKY

McKesson & Robbins, Inc.

Louisiana

The Udyrite Corp.

LOUISIANA

Hoosier Solvents & Chemicals Corp.

MASSACHUSETTS

Wm. Lynn Chemical Co., Inc.

MISSOURI

Stevens Co.

MISSOURI

Borden & Remington Co.

MISSOURI

Chemical Sales & Service Co., Inc.

MISSOURI

Dow & Ingalls

MISSOURI

Eastern Chemicals, Inc.

MISSOURI

Hamblet & Hayes Co.

MISSOURI

Howe & French, Inc.

MISSOURI

McKesson & Robbins, Inc.

MISSOURI

Textile Aniline & Chem. Co.

MISSOURI

Worcester Chemical Distributors, Inc.

MISSOURI

Wolverine Solvents & Chemicals Co.

MISSOURI

Western Solvents & Chemicals Co.

MISSOURI

Wolverine Solvents & Chemicals Co.

MISSOURI

Carrier-Stephens Co.

MISSOURI

Eaton Chemical & Dyestuff Co.

MISSOURI

Eccleston Chemical Co., Inc.

MISSOURI

Hanson-Van Winkle-Munning Co.

MISSOURI

The Udyrite Corp.

MISSOURI

Western Solvents & Chemicals Co.

MISSOURI

Wolverine Solvents & Chemicals Co.

MISSOURI

Worrell Chemical Co.

MISSOURI

W. D. Forbes Co.

MISSOURI

Lyon Chemical Co., Inc.

MISSOURI

McKesson & Robbins, Inc.

MISSOURI

Worrell Chemical Co.

MISSOURI

Jenkins-Guerin, Inc.

MISSOURI

Missouri Solvents & Chemicals Co.

MISSOURI

McKesson & Robbins, Inc.

MISSOURI

McKesson & Robbins, Inc.

MISSOURI

New England Chemical Supply Co.

MISSOURI

McKesson & Robbins, Inc.

MISSOURI

McKesson & Robbins, Inc.

MISSOURI

Brown Chemical Co.

MISSOURI

Chemical Solvents, Inc.

MISSOURI

Dooner & Smith Chemical Co.

MISSOURI

McKesson & Robbins, Inc.

NEWS

FEATURES

Compacts Still Untested

The compact cars of the Big Three still have to meet the big test of popularity, simply because the companies have not been able to produce enough of them.

Up to November, when the Valiant assembly line shut down for lack of steel, Chrysler Corp. had been able to build fewer than 9000 compacts. Even the dealers were cut short with nothing to sell and only a demonstrator and a show car on hand in most cases.

Chevrolet, with the earliest start and with three assembly lines going, built 57,000 Corvairs before steel supplies ran out. But with a larger dealer organization to supply, Chevrolet also was not able to fill orders.

Ford Div. built its 50,000th Falcon the week prior to Thanksgiving, but here again, there was not enough to fill orders. Ford cut its output to slow schedules in order to keep assembly plants running longer.

So a true analysis of the reception of the new Compacts will be impossible until well into 1960, if then.

The Independents, meanwhile, are basking in the light of their own success. American Motors reported that sales in the first 10 days of November were 62 per cent ahead of last year—9723 units compared to 6006. For the year, Rambler dealers delivered 317,733 cars, compared to 156,197 a year ago.

Studebaker-Packard reported that Lark sales in the first month following introduction were 46.6

GM TESTS STIRLING CYCLE ENGINE



This Stirling cycle engine is one of three experimental prototypes now being tested at General Motors Research Laboratories. Built by Philips of The Netherlands, the single-cylinder engine operates by external combustion. Top section contains a displacement piston over a power piston. The crankcase is in the lower section. A crank linkage developed by Philips permits excellent balance. The unit has no inlet or exhaust valves, resulting in silent operation.

per cent over the comparable period of 1959. Advance orders were the highest in five years.

Both S-P and American Motors, however, were able to maintain near-peak production while the Big Three assembly lines were halted or retarded.

But all is not gloom for the Big Three. Chrysler expects to resume Valiant production in early December, since supply lines were not emptied out when the assembly plant closed. And the corporation

is going to start building Valiants in the new St. Louis plant in January.

This will give a daily output of approximately 1230 units, with the Hamtramck plant building 880 on a two-shift basis.

Chrysler is also planning a 50 per cent increase in six-cylinder engine production at the Trenton, Mich., engine plant when steel supplies are back to normal. This would provide more engines for Valiant, Dart, and Plymouth.



A combination ramjet-rocket engine that uses only one fuel and carries an oxidizer for rocket operation has been developed by Marquardt Corp. The engine, named Hyperjet, was operated at simulated flight speeds more than five times the speed of sound at altitudes above 100,000 ft, according to Marquardt.

A new Thermo-Electric Generator may be used as a power supply in satellites to operate gyros, telemetering, and other equipment, says Pesco Products Div., Borg-Warner Corp. Heat from an outside source such as nuclear or waste heat is converted into electrical energy through thermocouples that operate on a 500 F minimum temperature differential.

Still another thermoelectric device, called a ferroelectric converter, has been developed by International Telephone and Telegraph Corp. This one uses ceramic insulating materials called ferroelectrics to convert heat directly to electric current. It can produce either alternating or direct current at high voltages, says IT&T.

Picker X-Ray Corp. has come up with a low-cost photofluorography technique for inspecting brazed metal honeycomb sections. Advantages claimed: gives the required sensitivity (3 per cent); good speed (145-sq ft/hr on 4-in. panel thickness); low operating costs.

A new "dry" phosphatizing process links vapor degreasing to spray-in-vapor painting in a complete metal finishing system, says Du Pont Co. Metal parts are sprayed with the phosphatizing solution and as they emerge from the vapor zone, the solvent evaporates, leaving parts dry and ready for immediate painting.

U. S. Rubber Co. is building a new facility for large-scale production of Flexone 3-C, the chemical that fights the effects of ozone and oxygen on tires. The unit will be located at the Naugatuck Chemical Div.'s main plant, with completion slated for the fall of 1960.

* * *

AeroGARD, a new concept in packaging, is made of durable, lightweight plastic foam covered with fabric skin. A product of Aerojet-General's Structural Plastic Div., it is ideal for fragile or difficult-to-package articles. Each product is supported over its total area, eliminating weight shifting or stress, Aerojet says.

* * *

Battelle Memorial Institute has formed an Electronic Reliability Center at its Columbus, O. laboratories. The new facility is supported by 11 of the nation's largest users and makers of electrical components. It pools reliability data sent in by member firms and is working out ways of improving reliability techniques.

* * *

More than 1000 high-temperature roller bearings are evaluated in an Air Force report published by Office of Technical Services. The volume can be used as a designer's guide to the best bearings for airframes. Copies of PB 151909 (Development of Oscillatory Rolling-Contact Bearings for Airframe Applications, \$2.50) may be ordered from OTS, Dept. of Commerce, Washington 25.

* * *

Midland-Ross Corp. has acquired Surface Combustion Corp. for \$23 million. Combined sales of the two companies for 1960 are estimated at \$120 million. Sales of Surface Combustion averaged about \$45 million in the last five years, with net profits averaging about \$2 million a year, Midland-Ross said.

AMC Plans 3rd Line

Plans are being laid to install a third final assembly line at American Motors' Kenosha, Wis., plant. The line would supplement the two existing lines, now operating at near-capacity.

According to reports, the new line will be installed at a cost of \$5 to \$7 million. One assembly line at Kenosha now turns out Rambler Americans and Sixes. The second line is assembling Sixes, Rebel V-8's and Ambassadors.

New Ford Subsidiary

Ford Motor Co. is setting up an insurance subsidiary to supplement the sales financing services of the newly formed Ford Motor Credit Co. The new firm, announced by T. O. Yntema, vice-president, finance, of Ford Motor Co., will provide automotive physical damage insurance as a service to dealers and customers.

Clark Opens S.A. Plant

A new automotive transmissions plant was opened at Valinhos, Brazil, by Clark Equipment International, C. A.

Built at a cost of \$4.5 million, the plant will produce transmissions, differential gears and other components for the South American market. The plant's facilities include a forging plant and heat treating equipment for handling raw steel. About 97 per cent of the raw materials used by the plant will be bought in Brazil, Clark said.

Perfect Circle Expands

Perfect Circle Corp. announced plans for a new \$3 million piston ring foundry near Rushville, Ind. The new facility, fully mechanized, will have three times the capacity of the present Rushville foundry it will replace.

CONTINUED

Automation Adds Jobs

What has been the effect of automation on employment in the United States? One answer to this vital question is offered by Louis G. Seaton, vice-president of General Motors in charge of personnel staff.

Seaton, testifying before the Senate Special Committee on Unemployment Problems, says "technological progress" (a polite term for automation) has added 100,000 good jobs to GM payrolls in the U. S. during the last 11 years.

This, according to Seaton, would "completely refute" the view that automation decreased job opportunities. "The soundest solution to unemployment is employment—more job opportunities through economic growth and technological progress," the GM V-P testified.

Since 1948, he stated, GM's U. S. employment has risen 29 per cent, or double the rate of growth in the country's total labor force during the same period.

Inco Develops New High-Strength Steels

A new family of high-strength nickel alloy steels has been invented in the Research Laboratories of International Nickel Co., Inc.

The new alloys, identified as 25 per cent nickel steels, achieve unique properties by simply air cooling from the heat treating temperature, the company said. Some properties: Yield strengths of 250,000 psi, with 6 to 10 per cent elongation and above 20 per cent reduction of area. Maximum hardness in excess of 67 Rockwell C. Excellent cold forming characteristics after a simple annealing treatment.

The elimination of liquid quenching, International pointed out, means that parts can be fabricated to close tolerances while the steel

ETOILE PRICED AT \$1659



The Etoile, a new sedan model in Simca's Aronde series, has a retail price of \$1659 at East and Gulf Coast ports of entry. This does not include Federal excise tax, and distribution and handling charges. The five-passenger car, billed as a "budget-priced" version of the Elysee, is powered by the Simca Flash engine rated at 50 bhp at 4800 rpm. Wheelbase is 96 in., overall length 165 in., and height 56.5 in.

is soft and then hardened to high-strength without appreciable distortion.

Another feature is that the new steels can be welded in the hardened condition without preheat. They also are readily hot worked and can be produced in all commercial shapes.

The steels' properties can be varied by changing the nickel content. The best combination, according to International, is about 25 per cent nickel, 2 to 6 per cent titanium and/or aluminum, carbon held as low as possible, silicon and manganese normal, and the balance iron.

The new steels are covered by a U. S. patent application of Inco. Although they are not yet commercially available, it is expected they will be produced by a number of steel manufacturers.

Parts for Off-Highway Vehicles Taxable

Manufacturers' sales of conventional automotive parts and acces-

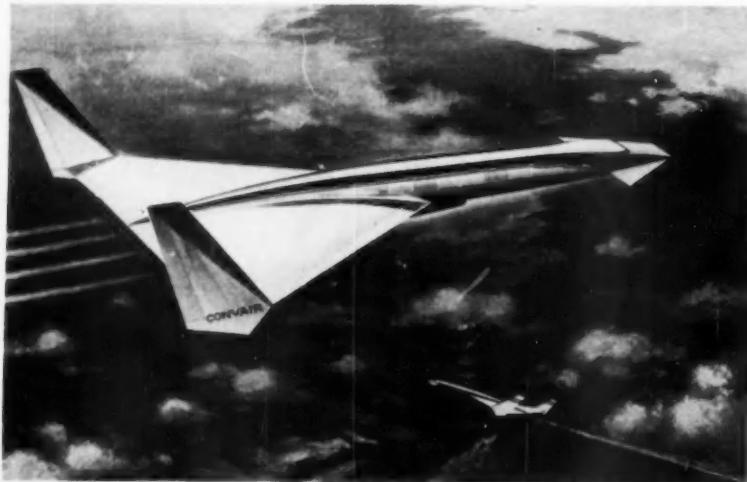
sories to operators of off-highway vehicles are subject to the Federal excise tax.

This is the Internal Revenue Service decision, as described in the new Revenue Ruling 59-362. The agency was asked for advice in relation to sales by a producer of Diesel engines and parts and accessories.

Primarily, the products are used on taxable highway vehicle chassis and bodies. But some of them are sold for repair or replacement purposes on nontaxable off-highway vehicles. These latter sales prompted the question whether the products must be taxed when they are to be used on nontaxable vehicles.

The IRS says there is no provision of law under which automotive parts or accessories may be sold tax-exempt as repair or replacement items on nontaxable vehicles. But an excise tax credit or refund may be allowed on such products (other than spark plugs or storage batteries) sold as repair or replacement parts for certain items of farm equipment.

AIRLINER OF FUTURE



The airliner of the 1970s may look like this, says R. C. Sebold, engineering vice-president of Convair Div. The delta-wing plane will fly more than 2000 mph, at altitudes up to 80,000 ft. Passengers will have television receivers instead of windows.

Ford, Chrysler Get Missile Awards

Two automobile companies—Ford and Chrysler—have received contracts for missiles work.

Ford's Aeronautics Div. has been awarded an \$8.6 million contract from the Army for work on the Shillelagh ground-to-ground guided missile, which Aeronautics has worked on from the beginning.

Chrysler Corp.'s contract is for production of modified Jupiters for use as targets in the new Nike-Zeus anti-missile program.

The new contract is a boon to Chrysler, since the final test firing of a Jupiter last month signaled

the impending end of the corporation's big money missile business. The modified target missiles will keep Chrysler's missile plant in operation beyond the phaseout of regular Jupiter production.

The target Jupiter will resemble its weapon predecessor on the outside. Different instrumentation, however, will make the target missile capable of simulating all types of trajectories, velocities, angles of re-entry and degree of operations. Thus, the Jupiter will be able to substitute for any enemy-type IRBM with a 1500-mile range.

N.A.S.A. Takes Over Project Saturn

The National Aeronautics and Space Administration has taken over responsibility for Project Saturn from the Army.

This action precedes the formal taking over by the N.A.S.A. of management of the Army space team headed by Dr. Wernher von Braun. President Eisenhower approved the transfer in October, but it cannot go formally into effect until sixty days after Congress reconvenes in January.

Meanwhile, it is expected that money to develop the Saturn rocket engine will be boosted sharply in

1960. The von Braun team working on the giant power plant recommends raising the budget to \$240 million. This amount would apply to the year beginning next July 1.

The Defense Dept. recommendation for this period is \$140 million. This year's budget for Saturn is \$70 million.

More Skyhawks Ordered

The Navy awarded a \$58.8 million contract to Douglas Aircraft Co. to build more A4D-2N Skyhawk aircraft. Previous contracts for the plane came to about \$173 million.

The A4D-2N is the third version of the Navy's lightest jet attack airplane, the A4D. It is a single-place, low-wing aircraft that can take off from carriers and short landing fields.

The plane is fitted with a removable nose probe for in-flight refueling. By mounting a "buddy" refueling store under the wing, it also quickly becomes a flying tanker plane.

The A4D-2N is powered by a Wright J-65 Sapphire turbojet engine. Speed is over 650 mph, range well over 1000 nautical miles. The plane is now under flight evaluation at Edward AF Base. First fleet deliveries are expected sometime this month.

"Eastern Bloc" Hungry for Data, AF Warns

Air Force contractors are alerted to be wary of requests for technical data from countries dominated by the Communists.

Nations in what it calls the "eastern bloc" are hungry for information on U. S. military production, the Air Force warns. These countries pester the arms and equipment producers for unclassified material such as sales bulletins and sales promotion manuals. Now the service wants its intelligence staff to screen these requests.

In letters sent out by Air Force procurement districts, contractors are directed to send to the foreign liaison branch of the intelligence staff any petitions from the Red-operated areas. The Air Force will decide whether requests for information should be answered.

Even in sending unclassified data to so-called friendly nations, contractors are cautioned to comply with U. S. State Dept. rules. The regulations order that written approval be sought from the State Dept. before such information is exported.

Exemptions to these rules apply to published material sold at newsstands or bookstores, or granted second-class mailing privileges by this Government. Also exempted are unclassified materials available at symposia attended by the general public.

GE Gets Nose Cone Award

General Electric Co. announced it has received a contract for \$101 million for further development of nose cones for Atlas, Thor, and other Air Force missiles.

The major portion of the award covers work on a nose cone to replace the ones now in use on Atlas missiles. Work on the contract has been going on since January at the company's Missile and Space Vehicle Dept. in Philadelphia.

The contract was announced at the annual meeting of the American Rocket Society in Washington, D. C., last month.

Minuteman Contracts

Boeing Airplane Co. awarded three subcontracts totaling about \$2.3 million for development work on the Minuteman ICBM weapons system.

The subcontracts call for development of transporter-erectors for hauling the missiles to launching sites, and containers and carriages for the first-stage engines.

One subcontract went to Pacific Div. of Bendix Aviation Corp. for an emplacement system to erect the missile and lower it into its underground launching site. The division's hydraulic department will head the project.

General Motors will provide the erector's carriage, tractors for towing the transporter-erector, and the container carriage for the first stage engine.

Cessna Aircraft Co. will design the container part of the transporter-erector and a container for a first-stage engine.

Lockheed Gets Award

Lockheed Aircraft Corp. received a \$19.2 million contract for GV-1 aircraft from the Navy. The aircraft, for use by the Marine Corps, will be built at Lockheed's Marietta, Ga., plant.

The GV-1, a Navy version of the C-130B Hercules, can be used as a tanker or as an assault transport. Powered by four Allison T56 turboprop engines, the GV-1 has short take-off capabilities.

NEWS

FEATURES

CONTINUED

FLYING HOSPITAL



Model of a British helicopter is a development of Westland Westminster. The 70-ft chopper, powered by two turbo-shaft engines, is designed to carry prefabricated medical wards for use as field hospitals. The wards, below the bug-like vehicle, would hold up to 40 casualties.

New Braking System Has Electronic Brain

A new aircraft braking system that uses proportional pressure instead of the "on-off" type was announced by Hydro-Aire Co. The company said the system, called Hytrol Mark II, has been accepted for the new Convair 600 jet liner.

Hytrol Mark II differs from other anti-skid braking systems in its use of an analog computer to meter pressure to the brakes. The computer has a built-in memory, pulse emitters for each wheel, and a pressure metering valve per braked wheel.

The computer senses pulse frequency from each wheel unit as wheel speed. As wheel speed changes, one electronic circuit for each wheel follows the change, while a common memory circuit follows the speed of the fastest rolling wheel.

As long as the two circuit voltages are the same, no current flows

to the control valve. Whenever a difference is sensed, current is sent to the valve to cut metered pressure. This current is proportional, not linear, to the difference.

The company said tests showed that brake pressure should vary non-linearly to "full off" at about 25 per cent slip. The actual values and relationships will be set to meet the needs of specific aircraft, the company said.

Conventional braking systems can be converted to proportional systems by adding the new system components, Hydro-Aire pointed out.

Other advantages claimed: It is more rugged and is about half the weight of the original Hytrol system. Its control box is completely transistorized, and thus is immune from the effects of outside vibration. The system also cuts tire wear.

MEN IN THE NEWS



Waldes Kohinoor, Inc., Truarc Retaining Rings Div.—H. Roberts has been appointed manager of engineering services.



Tung Sol Electric Inc.—E. L. Peter was named sales manager of the newly formed Canadian Div.



Globe-Union Inc.—W. T. Warrender has become vice-president in charge of administration.



National Screw & Mtg. Co., Chester Hoist Div.—R. A. Davies was appointed sales manager.



Rockwell - Standard Corp.—N. R. Brownyer is now director of research and development for all divisions and subsidiaries.



Bendix Aviation Corp.—D. M. Heller was named assistant group executive in charge of aircraft and automotive sections of the Products Div., and F. C. Weyburne assistant group executive in charge of six Bendix manufacturing divisions.

Eaton Mfg. Co., Valve Div.—H. M. Reigner was appointed new products manager.

Thompson-Ramo Wooldridge Inc., Michigan Div.—R. M. Lynas was named manager of the Hydraulic Product Works and J. A. Poremba assistant manager of the Van Dyke Works.

Clark Equipment Co., Industrial Truck Div.—J. W. Ross has been appointed manager of primary metals industries sales.

Ford Div., Ford Motor Co.—D. W. Lee was made truck field services manager.

Cleveland Punch & Shear Works Co.—C. E. Huddleston was elected executive vice-president.

Firestone Tire & Rubber Co.—H. S. Richard was named director of racing; W. R. McCrary, general sales manager of race tires; and C. E. Stair, manager of race tire development.

Chrysler Corp.—H. C. Cook and J. C. Guenther were appointed to the staff of B. W. Bogan, vice-president.

Amchem Products, Inc.—J. Geyer was promoted to technical assistant to the president.

A. O. Smith Corp.—J. E. Borchert was made director of procurement.

United-Carr Fastener Corp.—E. J. Pool was elected to the board of directors.

White Motor Co., Reo Div.—D. J. Sherman is now public relations and sales promotion manager.

Calumet & Hecla, Inc., Wolverine Tube Div.—R. E. Seaton has been promoted to manager of processing and power sales.

Allison Div., General Motors Corp.—F. C. Spinney was named manager of research sales.

Gisholt Machine Co.—H. S. Johnson retired as executive vice-president after 35 years of service.

New York Air Brake Co., Hydrex Div.—H. W. Brandt has been promoted to vice-president of the company.

J. I. Case Co.—J. H. Brinker was elected executive vice-president.

Aerojet-General Corp.—G. Wolf was made manager of the newly formed Detroit district office.

Westinghouse Electric Corp.—R. J. Stefanoff has been appointed manager of government and aviation sales.

Blackhawk Mfg. Co., Automotive Div.—K. W. Rodeman was named advertising and sales promotion manager.

Ford Motor Co., Aeronutronic Div.—Dr. L. P. Smith is now director of research operations.

U. S. Rubber Co.—Dr. E. M. Bevilacqua was promoted to senior research scientist at the Research Center.

Deere & Co.—E. F. Curtis has been elected executive vice-president.

Nylok-Detroit Corp.—E. N. Walsh was appointed plant manager.

Bendix Aviation Corp., Bendix-Pacific Div.—J. G. Weldon was made manager of the hydraulic department.

Arcoats Corp.—H. M. Peterson has been appointed vice-president and controller.

Perfect Circle Co., Ltd.—W. B. Dodds was named vice-president and general manager.

Necrology

Ralph P. Garrison, president of Garrison Machine Works, Inc., died Nov. 15, at Dayton, O.

T. S. Day, 42, manager of specifications and records for product engineering at Willys Motors, died Nov. 13, at Toledo, O.

Dr. W. H. Schuette, 47, a vice-president of Dow Chemical Co. and general manager of its Midland Div., died Nov. 8, at Midland, Mich.

Miles S. Houser, 66, inventor of the Houser Steering Stabilizer and other automotive devices, died recently, at Bluffton, Ind.



DOT

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COST-CUTTING
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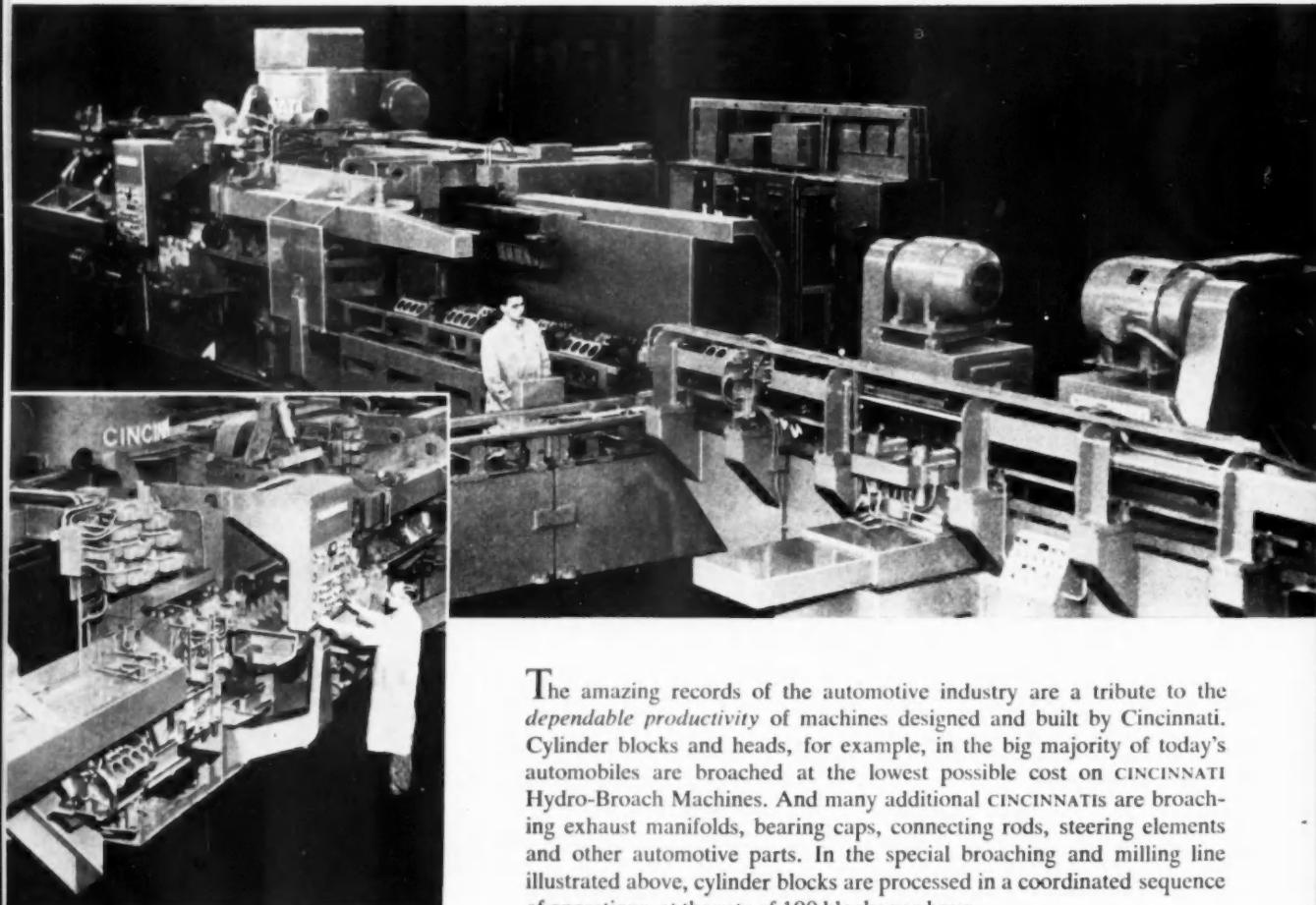
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Broaching and milling of cylinder blocks are coordinated in this dependable productivity team of a CINCINNATI Hydro-Broach and CINCINNATI Special Duplex Milling Machine. Inset shows broaching station.

The amazing records of the automotive industry are a tribute to the *dependable productivity* of machines designed and built by Cincinnati. Cylinder blocks and heads, for example, in the big majority of today's automobiles are broached at the lowest possible cost on CINCINNATI Hydro-Broach Machines. And many additional CINCINNATI are broaching exhaust manifolds, bearing caps, connecting rods, steering elements and other automotive parts. In the special broaching and milling line illustrated above, cylinder blocks are processed in a coordinated sequence of operations, at the rate of 100 blocks per hour.

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Adding Up the Dividends



an Editorial

WITH A NEW YEAR LOOMING UP AHEAD and the general outlook for establishment of new high records for the National economy, it seems a proper time to offset the short term outlook of the effects of the steel strike with a longer view. In the total setting, the performance of the automotive industries during 1959 has been nothing less than spectacular. Major new designs of vehicles have been developed and introduced successfully. The manufacturing organizations of the industry have been modernized in form and capability and such steps have set the stage for further advances in production in 1960. The distribution trades have responded with an enthusiasm which reflects an unusually high level of confidence in the outlook for sales in 1960.

BUT THERE ARE ALSO MANY MORE dynamic aspects of this field than have been evident to the public. The automotive industries have grown much stronger financially. Their capability for service to America has been vastly strengthened. Their concentration on reliability and quality control has been a movement of such importance and technical merit as to be virtually unprecedented. Their adaptation of design and engineering concepts from other industries such as aircraft manufacturing, machinery building, and electrical manufacturing, has resulted in some major "firsts" which will assure progress in safety, convenience and economy for their customers everywhere.

THE TOTAL RESOURCEFULNESS and capability of the automotive industries has been one of the main reasons why the steel strike has not touched off a National economic depression. Because of this fact, it is important for the entire country to realize that this resourcefulness and capability is a major National resource which must not be impaired.

AMERICA'S DIVIDENDS from the automotive industries include even more than the brief facts which have been cited. Because of such advances there are more opportunities than ever for young people to learn new sciences and technologies

which have practical applications. There are more major job opportunities opening up for 1960 than can be filled by available applicants. There are more new needs for social scientists in these industries, in addition to experts in the engineering functions and applied sciences, than have been realized Nationally by the leaders of education.

THERE IS NO REPORT or recapitulation available of the many major projects of aid to local, State and National Governments which have been fulfilled by the automotive industries. There are no adequate reports of the services rendered to such major functional fields as agriculture, transportation, communications, trade and scientific research. In brief, only those persons whose work has involved such projects know and realize the importance of such specific and tangible dividends of the automotive field to America.

THE YEAR 1960 BRINGS A CHALLENGE to all of us to do a better job of specifically reporting these vast dividends so that there can be a more complete and useful record available. To be most useful and meaningful, it must be complete with maximum details about such aspects as consumption and uses of materials and parts, advances in original equipment components, innovations in electrification, materials handling, grinding, surface finishing, and other production techniques. Perhaps, also, it might be more convincing if more executives, engineers, researchers, designers, plant managers and other operating executives could tell the details of such steps in order to more effectively personalize the appearances of the automotive industry corporations in their presentations of vital facts. Even "dividends" must have the human touch.

A cursive signature of Harry W. Barclay.

Editor and Publisher

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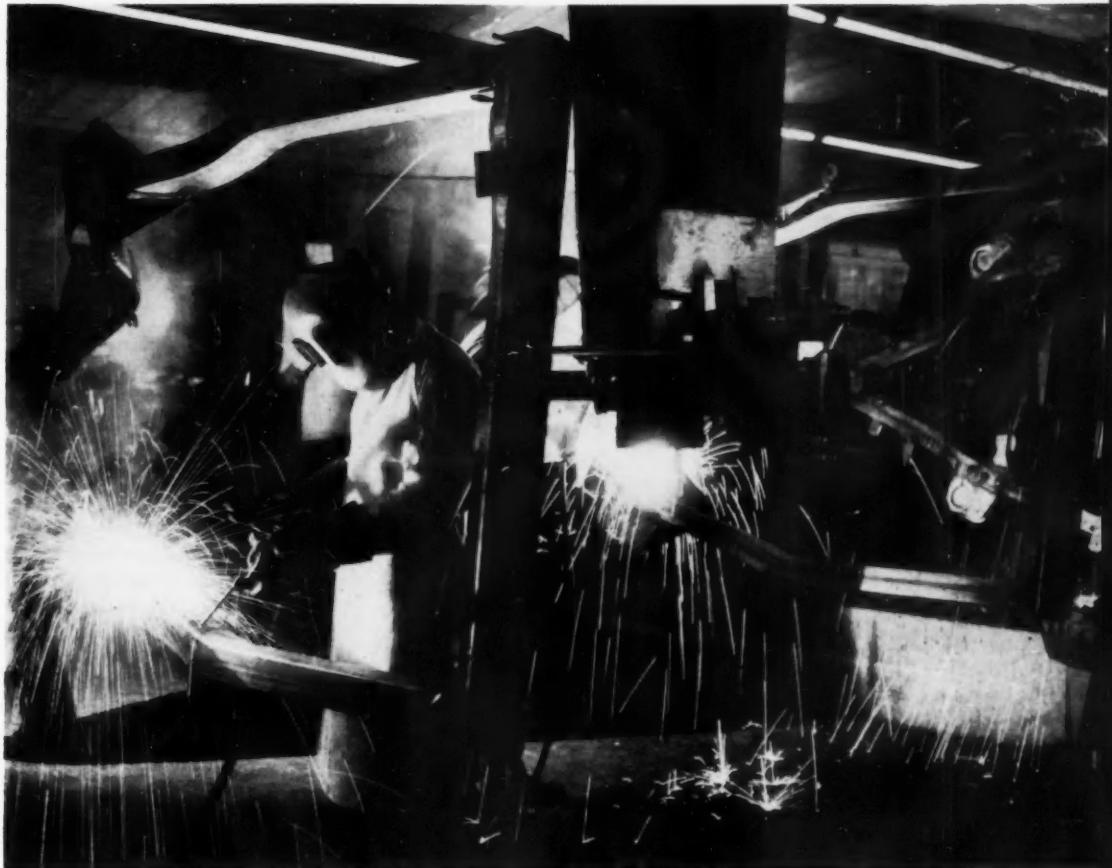


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Frame is manually arc welded at Chevrolet Frame and Stamping Plant in Flint, Mich.
(Chevrolet Motor Div., General Motors Corp.)

WELDING— Primary Production Method for Motor Vehicles

PART I

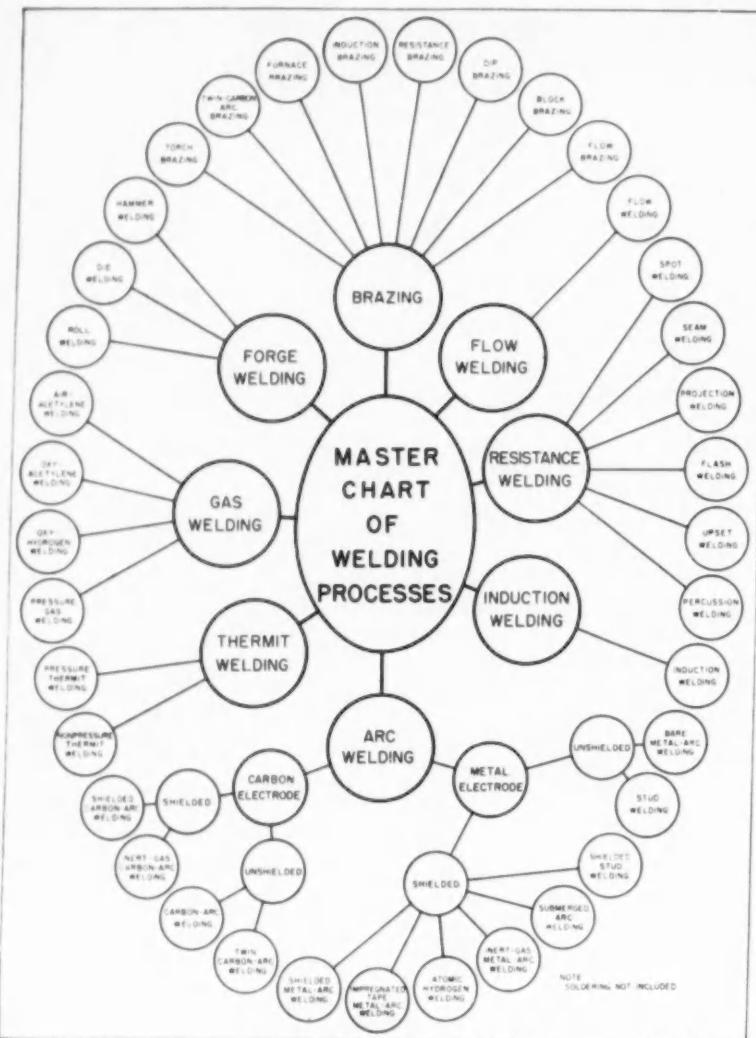
**Automatic and Semi-Automatic
Arc Welding Processes Gain Ground,
Although Manual Methods Remain
Widely Employed**

By Andrew W. Shearer

MARKET RESEARCH EDITOR

SIMPLY stated, welding is the process of joining two pieces of metal by melting them directly together, with or without the application of pressure and the use of filler metal. Included under this definition are the following general groups of processes: arc welding, resistance welding; gas welding; brazing; thermit welding; forge welding; induction welding; and flow welding (see master chart of welding processes).

Although classified as a welding process, brazing differs somewhat from the others. It joins two pieces of metal by means of a *lower melting point* metal which flows between them and bonds to them *without* melting the base metal itself. Due to this difference, brazing will not be included in this dis-



cussion, but may form the basis of a later study.

Welding is the primary method of fabrication in the modern motor vehicle. The first three of the processes mentioned above—arc, resistance, and gas—are the most important in automotive manufacturing, although practically all of the common welding and allied processes are used. The number of welds and the quantity of automotive parts fabricated by welding are increasing each year. Table I shows the numbers of welders installed in the plants of a representative cross-section of major automotive manufacturers as of the end of 1958 (approx.).

There are a number of factors peculiar to automotive manufac-

ting that make for a somewhat different approach to welding problems as compared with methods used in some other industries. For

example, the high production rates encountered in most automotive plants have a decided influence on the selection of welding processes for various fabricating operations. While much of it is still used, manual welding is giving way more and more to semi-automatic and automatic methods. Lesser skills are required, and higher outputs per man are attainable.

The high-volume output of automotive manufacturing, together with the stress laid on reducing labor and materials costs, accounts for the large quantities of specialized welding equipment used. Many of these machines can produce hundreds of welds in a single operation. Of course, this equipment must be designed so that changes to adapt it to the production of new models will be at a minimum.

Resistance welding is the most extensively used process in automotive manufacturing. There are, for example, about 8000 resistance welds in an automobile body. Arc welding is growing by leaps and bounds, however. It is estimated that some automobile frames have from 300 to 500 in. of arc welding used in their fabrication. Gas welding is also widely used, particularly for maintenance operations.

The first and second parts of this four-part article will cover arc welding for automotive applications. Part III will be devoted to resistance welding, while the fourth and final section will be concerned with gas welding and miscellaneous welding methods. Defi-

TABLE I
TYPICAL AUTOMOTIVE
WELDING EQUIPMENT INSTALLATIONS*

Manufacturer	Total	0-5 Yrs	5-10 Yrs	10 Yrs & Older
Buick	459	154	142	163
Cadillac	344	110	138	96
Chrysler Corp.	6325	2475**	2475**	1375
American Motors Corp.	365	292	55	18
Company X***	2233	775	905	553
Studebaker-Packard Corp.	1500	—	200	1300
Oldsmobile	323	83	82	158
Totals	11,549	3889	3997	3663

* As of the last quarter of 1958 (approx.).

** True breakdown of total 4980 units under 10 yrs of age not available; division author's estimate.

*** Permission not given for identification.

nitions of the various welding processes are taken for the most part from the *Welding Handbook, Fourth Edition, Section Two*, published by the American Welding Society.

ARC WELDING

Arc welding is a fusion process in which the heat of an electric arc or arcs is concentrated on the surfaces of two pieces of metal to be joined. Pressure may or may not be applied, and filler metal may or may not be used. The surfaces are melted into a liquid state and then allowed to solidify.

The electric arc is made between the tip end of a small metal wire—the electrode (fixed in a suitable holder)—and the work to be welded. When the arc is formed, the temperature of the work, at the point under the tip of the electrode, jumps to about 6500°F.

The various types of arc welding can be classified by the type of electrode—carbon or metal—used. Welding with these electrodes, shielded or unshielded, further identifies the arc welding method. The following are the

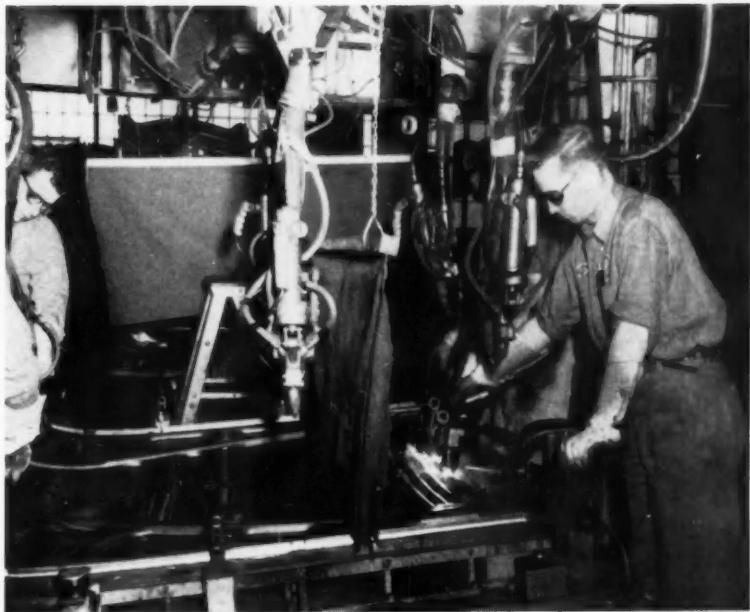
FAMILIAR ARC WELDING PROCESSES

I CARBON ELECTRODE

- A—Shielded
 - (a) Shielded carbon-arc
 - (b) Inert-gas carbon-arc
- B—Unshielded
 - (a) Carbon-arc
 - (b) Twin carbon-arc

II METAL ELECTRODE

- A—Shielded
 - (a) Shielded metal-arc
 - (b) Impregnated tape metal-arc
 - (c) Atomic hydrogen
 - (d) Inert-gas metal-arc
 - (e) Submerged arc
 - (f) Shielded stud
- B—Unshielded
 - (a) Stud
 - (b) Bare metal-arc



Pressed steel reinforcement is arc spot welded into position on automobile hood. Steel frame stiffens and strengthens the hood panel (Cadillac Motor Car Div., General Motors Corp.)

Equipment (General)

Arc welding machines may be motor-generator sets, rectifier sets, transformers, or generators driven by any of the common prime movers. The selection of equipment for any given operation will be determined by such factors as thickness of metal to be welded, costs involved, lengths of production runs, etc.

Either alternating current (ac) or direct current (dc) may be used for many arc welding applications with good results. However, the former is not used for any of the inert or CO₂ processes, which cover most of the semi- and fully-automatic methods.

A-C MACHINES

These machines are made both as rotating equipment and in single and multiple operator, static transformer types. Units with ratings of 750 amp or more are primarily used for machine welding with automatic welding heads. Those with ratings of 200, 300, and 500 amp are most commonly used in manual arc welding operations. Some machines with ratings of 200 amp or less are used for light duty welding applications.

Single-operator machines are

single-phase units made for a power supply of 230, 460, or 575 volts and 25, 50 and 60 cycles. Some multiple-operator transformer units are set up for polyphase operation. Practically all a-c welding machines today are equipped with power factor correcting capacitors. In addition, a number of control devices are now available in the form of safety elements, relays, remote controls, etc.

D-C MACHINES

Included in this category are the variable-voltage generator, rectifier, combination ac-dc, and multiple-operator equipment. Direct current is usually required with shielded and unshielded carbon arc welding, inert-gas carbon arc welding, bare-metal arc welding, and stud welding.

A *variable-voltage welding generator* is one whose voltage at any setting within an established welding range reduces automatically as current increases. A generator of this type is normally supplied for each welder. In cases where several welders are to be supplied from one machine, a *constant-voltage generator* is used. When no electric power is readily available, both gasoline and Diesel engines

are frequently used to drive welding generators.

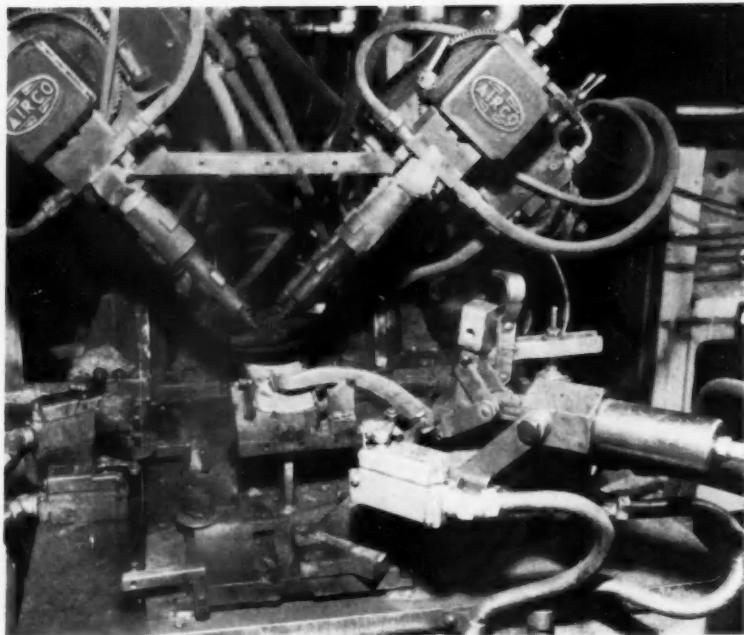
Rectifier-type machines convert the normal alternating current of the power line into direct current without the intermediate step of mechanical rotation required in motor-generator welding machines. They are classified in two general types, depending on their volt-ampere curves and their applications.

Constant-current rectifier-type welding machines are those which show a sizable droop in their volt-ampere curves. As a general rule, they are most suitable for single-operator, manual welding operations. The term "constant-current" is applied to these machines because the welding current remains fairly constant for small variations of arc length. The current may be controlled by both mechanical and electrical means.

The second general kind of rectifier-type welding machine is the *constant-potential* unit. It is intended specifically to power automatic welding processes which use a continuous length of wire, fed at a constant speed, as an electrode. The burn-off rate is controlled by the current sensitivity, and a uniform arc length with constant speed of wire feed maintained. The volt-ampere curve comes close to being a straight horizontal line.

The *combination a-c/d-c rectifier-type* is basically a true a-c welding machine with a rectifier attached. The rectifier, however, differs in configuration from that used in the strictly d-c machine. It is a single-phase bridge and must have a higher voltage rating per leg for equivalent d-c output voltage than a three-phase unit. One common feature of these machines is the use of a good size reactor in the d-c output circuit to reduce the ripple percentage.

In view of its versatility, the a-c/d-c type of machine is becoming more and more popular. A simple flip of a switch to one of three positions enables the welder to use alternating current or straight or reverse polarity direct current. Other advantages of the unit are: it can be used in locations where



Brake pedal pads are welded to brake pedal arms on this CO₂ gas shielded arc welding machine at the Buick plant in Flint, Mich. The pads and arms are hand loaded into the machine, and a fully automatic welding cycle makes two welds at the same time. (Buick Motor Div., General Motors Corp.)



Roof assembly being welded to unit frame body at American Motors Corp. Roofs are first arc welded at corners, then spot welded manually on all sides to the body frame (Air Reduction Sales Co.)

only single-phase power is available; it does away with the need for having two independent units of the same rating; and it occupies less floor space.

Primary disadvantage of this type of equipment is unbalanced loading on three-phase supply line because of single-phase primary

(Turn to page 60, please)

American Zinc Institute Symposium

Improvements in Quality of Plated Zinc Die Castings Revealed at Meeting in Detroit

DETAILS of new and improved processes for the electro plating of zinc die castings, used by the automobile and other industries, were brought out at a symposium conducted by the American Zinc Institute in Detroit, November 11-12. Approximately 200 engineering and marketing executives of the zinc consuming industries heard technical representatives of the plating supply and the zinc industries describe some of the new developments.

John L. Kimberley, Executive Vice-President of the American Zinc Institute spoke before the opening session of a special symposium on "The Plating of Zinc Die Castings." The purpose of the symposium, he said, was to present findings by a number of researchers among platers, suppliers to the plating industry, as well as the consumers of chromium plated zinc die castings, and the zinc industry itself, resulting from investigations conducted during the past several years.

Research was begun because it was sometimes found in the past that chrome plated zinc die castings failed prematurely—that is, unsightly surface pitting and blistering were encountered quite early in the part's service life. This is particularly important as a marketing factor, since chrome is used on zinc die cast parts to enhance appearance—for example, in such automotive applications as door and window handles, grilles, rear view mirror assemblies, headlights and tail-light housings, and many more,

according to Mr. Kimberley.

A number of reasons have been advanced for past failure. Whatever the precise reasons, it was apparent that product quality had to be improved if an important market for plated zinc die castings was not to be jeopardized.

The results of research by many phases of the industry represent major improvements that promise many times the corrosion resistance achieved with plating processes conventionally used in the past, Mr. Kimberley said, and is documented by the fact that virtually all segments of the automobile industry are already using one or more of the improved techniques in the production of 1960 cars.

R. B. Saltonstall, The Udylite Corp., Detroit, and D. R. Millage, The Udylite Research Corp., Warren, Mich., presented a paper on "The Correlation of Outdoor Exposure, Service and Accelerated Tests on Chromium Plated Bright Work." Based on somewhat limited preliminary efforts, they drew the following conclusions from data obtained in their different types of tests:

(1) The CASS (accelerated acetic acid salt spray) and Corrodkote, as well as static roof exposure, were appreciably more severe on 1.0 mil nickel + 0.01 mil chromium than one winter on mobile test sites.

(2) Neither the CASS, Corrodkote, nor static roof exposure correctly predicted that the effect of 0.03 mil HT-HR chromium, compared with 0.01 mil conventional chromium on 1.0 mil bright nickel,

at the end of one year service exposure would be harmful.

(3) The marked superiority of the composite nickel coatings (80 percent sulfur free—20 percent bright nickel) compared with an equal thickness of bright nickel, which was apparent in the accelerated tests, was not apparent in the mobile tests, and only slightly apparent in our roof exposure.

The unexpectedly good behavior of the bright nickel-chromium deposits on mobile test sites tends to confirm an observation made previously, viz., that failure to specify adequate bright nickel thickness, and/or failure to enforce specifications has resulted in untimely failures.

The danger in translating or interpolating correlation between accelerated tests and service exposure from one coating system to another, or even within the same system when variables in types of coatings are introduced, has been pointed out many times. In spite of this, there is an understandable but highly undesirable tendency to specify the new accelerated tests for many coatings and materials without proper correlation. This practice should be discouraged to the greatest extent possible.

There may be some danger of being lulled into a sense of false security, if we predict the serviceability of plated articles entirely on the basis of the accelerated tests. The striking improvement in test results of thin bright nickel deposits resulting from the application of very thin chromium, particularly in the Corrodkote test, is a case in point. Relaxation of nickel thickness requirements based on results of accelerated tests on different coating systems without service correlation may be premature.

(Turn to page 51, please)

Assembling THE DART

View of a portion of the pre-final line on the third floor for the Dodge Dart. Bodies here are suspended from the monorail on special carriers over the final stages in this area, then transported to the body drop nearby.



WITH the general adoption of unitized bodies in the Chrysler family of cars, it may be of interest to observe the changes that have been made in final car assembly procedures. In the process our readers can compare the new approach with the procedures employed by other manufacturers as they introduced unitized bodies. The entire record will be found in the pages of *AUTOMOTIVE INDUSTRIES*.

As an example of current practice we have selected the final assembly of the Dart which, as our readers

may know, is produced on the same line as the Dodge at the Hamtramck assembly plant.

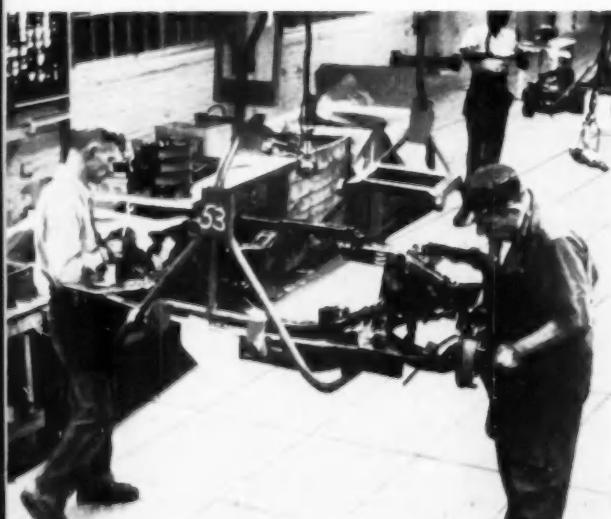
To digress for a moment, this division achieved a complete metamorphosis of its plant, under the leadership of J. B. Neal, plant manager, in an amazingly short span of time. Between the time 1959 production was halted and 1960 production scheduled to start there was left an interval of but four weeks. Within that short space of time the entire plant was cleared; they created new body fabrication facilities, paint shops, trim, etc., for both Dart and Valiant bodies; and installed the assembly line for Dodge and Dart and a separate line for Valiant.

Final result was an entirely new car building operation, although it is housed in the same old multiple story shell in Hamtramck.

Dart final assembly is noteworthy because it features a unitized construction in which the body shell ends with the firewall at the front. Consequently, it is necessary to attach a "stub" frame at the front to accommodate the engine, radiator, hood, removable front fenders, and front sheet metal.

Since this article is confined to final assembly operations, we start with the pre-final overhead conveyor system on the third floor which carries the bodies through the final finishing stages just ahead of the body drop to the second floor. The conveyor system from the body bank to the body drop runs some 1620 ft.

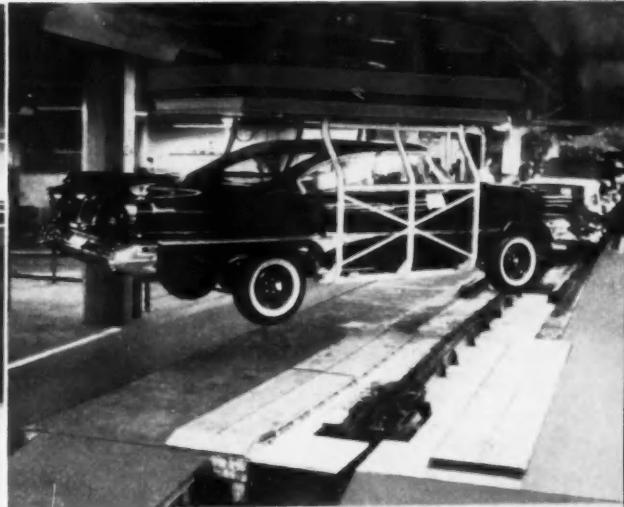
The third floor too has a suspended assembly conveyor line with 20 stations for the stub frame. Stub frames are received from a Chrysler Corp. stamping plant, delivered to Hamtramck where they are trans-



Several stations of the stub frame conveyor on the third floor are seen in this view. The entire front suspension system, including torsion bars and brakes, is installed here prior to the drop to the assembly line.



The final assembly line on the second floor right at the body drop. At this stage the assembly conveyor is carrying the entire running gear on the front and rear pedestals.



At the end of the final assembly line the car is picked up by the overhead traveling hoist, transported around a 90-degree bend to final preparation and inspection, foreground.

ported on a monorail conveyor to the third floor. At a number of stations the stub frame is fitted with the necessary small details as well as the front suspension system, including torsion bars. Then the conveyor continues on its course down to the second floor where it meets the final assembly line.

Final assembly takes place on the second floor on a slab type floor conveyor fitted with pedestals on the plates. As illustrated, the pedestals are arranged in pairs—one for the front end of the car, the other for the rear end. Plates are arc-shaped with suitable clearance between them to permit free articulation around two right angle bends that define an open U—course about the department. Total developed length of this continuous conveyor line is 1560 ft.

First stage on this line is the installation of the stub frame on the front pedestal. An interesting feature here is the automatic release of conveyor hooks that carry the stub frame over the assembly

mission, the combination of the larger V-8 with automatic transmission weighing around 900 lb.

The powerplant is dropped into the stub frame

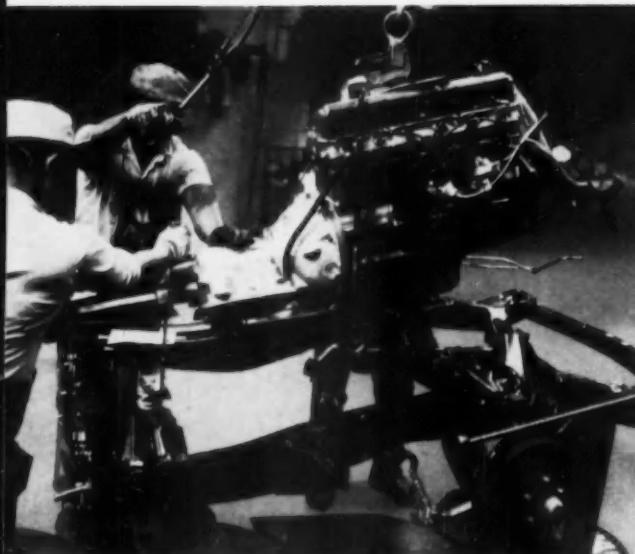
Partial view of the engine schedule conveyor which transports complete powerplants to the final line.



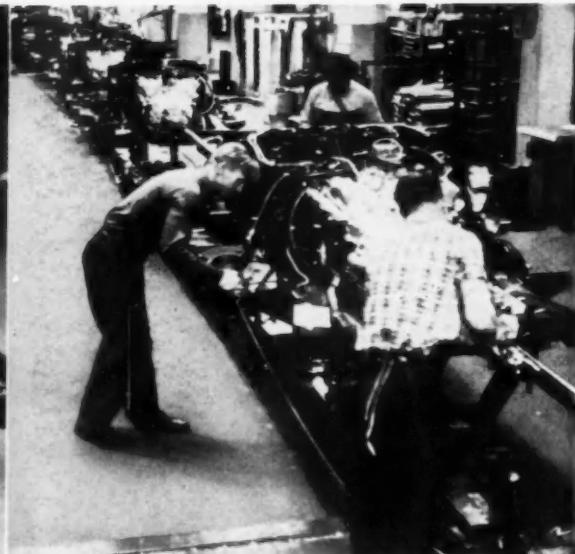
By Joseph Geschelin

DETROIT EDITOR

line. In this area is an impressive engine dress-up line, employing special carriers capable of holding any kind or size of engine. From the dress-up line engines are transferred to a scheduling conveyor from which the assembly line is served. This is a real heavy duty conveyor system with carriers traveling on a 6-in. I-beam. Incidentally, the line supplies complete powerplant assemblies i.e., engine and trans-



Close-up of engine drop station on the final line. This gives the detail of the front pedestal supporting the stub frame at both ends. Note too the articulated base for the pedestal on the floor conveyor.



Perspective of the final assembly line past the engine drop. Brake hydraulic lines and other details, including the radiator, are being installed.

and fastened, this being followed by installation of the radiator. Following this, the rear assembly consisting of the rear axle and leaf springs—supplied from a sub-assembly station—is fitted at the rear pedestal. Then the drive line is attached to the rear axle. It is left unconnected at the front end to permit free travel around the second bend, fastened to the transmission after the bend has been negotiated.

Along the straight stretch of final conveyor immediately beyond this point is the body drop from the second floor. Bodies come in fitted with steering gear and rear shock absorbers to facilitate installation and as they are lowered over the pedestal conveyor they are carefully aligned to mate the fastening points at the front end with the stub frame. Accurate alignment of body and subframe at the junction is effected by shimming. To this end, each body is aligned in a fixture before delivery to the assembly line. The clearance is measured accurately and marked in code on each side of the firewall. This code then determines the number of shims to be installed by the operator on each side of the line.

In succession line workers install the separable fenders, hoods, bumpers, grille, and other details. Meanwhile, other assembly line workers handle the fastenings and attachment of details under the car from suitable pits. Noteworthy feature of the final line is that the ramp on the side is built up at different levels for the convenience of the workers.

In the operation described so briefly above the speed of individual conveyors as well as the synchronization of the entire network of conveyors must be precisely timed if the system is to operate smoothly on schedule. To this end they have in operation a

Varidyne electronic control system for effecting both speed and timing in precise synchronization. One of the control units is located on the second floor to handle the assembly conveyors. Another unit is located on the third floor to control the third floor conveyors and to synchronize them with the system on the second floor.

Returning to final line, as cars near the end of the line they enter the wheel and tire station where the assemblies are delivered by chutes on each side of the line. Chutes are scheduled to deliver five wheel and tire assemblies for each car. The fastenings are made up in the usual manner by means of five-spindle Thor multiple-nut runners.

At the last station the completed car is picked up by an overhead-mounted traveling hoist and transported around the bend to the left to the inspection conveyor located at right angle to the final line. Here the car is serviced, engine started, torsion bars adjusted, and final-inspected. This line also adds special accessories specified by the customer.

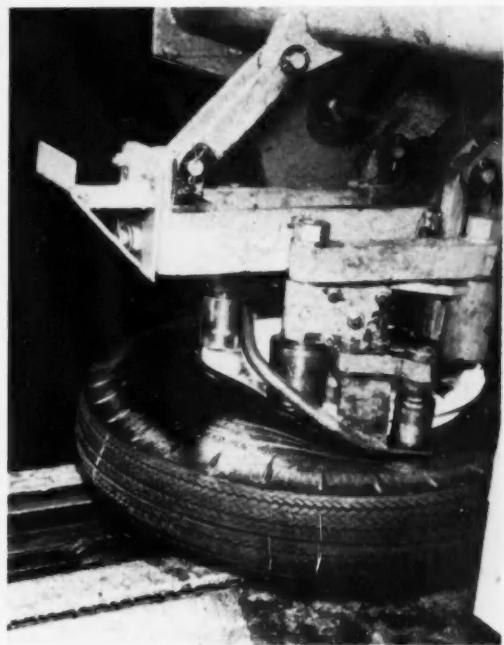
This plant has also developed a fully automatic scheme for making up wheel and tire assemblies, including tire inflation and balancing. As illustrated, this station is located on the second floor within easy reach of the wheel chutes serving the assembly line. Wheels come in from the paint booths on an overhead conveyor, are unloaded onto an inclined conveyor section where an operator drives home the tire valve. Meanwhile tires come in on another conveyor and are unloaded into a chute which runs at right angle to the wheel conveyor.

The junction of the two conveyors is synchronized so that a tire rolls down just in time to meet a wheel,



Details of wheel and tire assembly. Wheels come in on the conveyor in the foreground from the extreme right. To the right, out of this view, an operator has installed the tire valve. Meanwhile, tires are fed to the station by the chute in the center. At the junction of the two conveyors the tire drops over the wheel as the wheel sweeps under the tire.

the tire dropping loosely over the wheel. The next station is an automatic tire rolling operation, using a newly designed mechanism which handles the rolling smoothly and rapidly. The assembly continues



As the wheel and tire move along the conveyor they enter the second station where the tire is rolled automatically into the wheel rim.

into an automatic inflation station, then proceeds on an inclined conveyor section to meet the feeder conveyor for transport to the final assembly line chutes. Interesting feature at the junction of these two conveyors is an automatic pick-up arm which hooks into the wheel and tire assembly to effect the transfer onto the monorail conveyor. ■

American Zinc Institute Symposium

(Continued from page 47)

However, Mr. Saltonstall and Mr. Millage said "it is not in any way our intent to deprecate or discourage the use of the new accelerated tests, but rather to point out that there are possible pitfalls if they are incorrectly used."

In a paper on "The Contribution of Nickel and of Chromium to the Durability of Decorative Plating," C. H. Sample, the International Nickel Co., Inc., reviewed some observations of the corrosion behavior of various decorative plating systems and presented some opinions as to the reasons for the behavior differences noted. In summary, Mr. Sample said:

From the standpoint of protecting the basis metal against corrosion, recent experience has shown that fully bright nickel is more variable and generally inferior to buffed dull nickel of the same thickness, when plated with conventional chromium of conventional thickness.

"Duplex" nickel coatings when plated with conventional chromium of conventional thickness provide basis metal corrosion protection substantially equivalent to that of chromium plated buffed dull nickel of the same thickness.

The application of "heavier than normal" chromium coatings

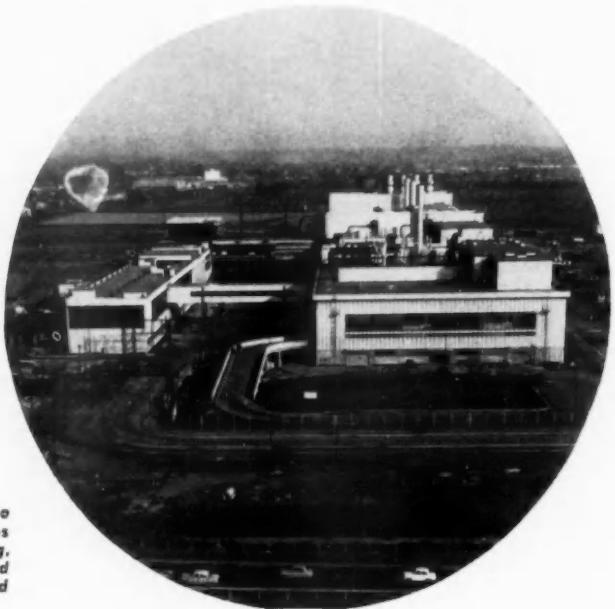
to those bright nickels which are adversely affected by conventional chromium plating, markedly improves the protective value of the combination. However, since such coatings systems are relatively new, further experience with them will be required to establish their advantage over an improved nickel substrate from the points of view of relative economy and long term durability.

Combination copper-bright nickel-conventional chromium coatings may exhibit better protective value for a limited time than comparable coatings without copper but even at best such coatings fall far short of the high standards of durability established in the industry years ago with buffed dull nickel-conventional chromium, now available with duplex nickel systems. ■

FORD'S New Foundry in Britain

By J. Grindrod

The Thames Foundry from the West. The main building to the right is over a quarter of a mile long and incorporates the main foundry operations of melting, pouring, moulding, coremaking and fettling. The smaller building contains sand handling and drying, casting, cooling, sand removal and grinding sections.



SAID to be equal to the most modern plants in America, a new \$20 million Thames foundry has recently been placed in operation at Dagenham, Essex, England, by the Ford Motor Co.

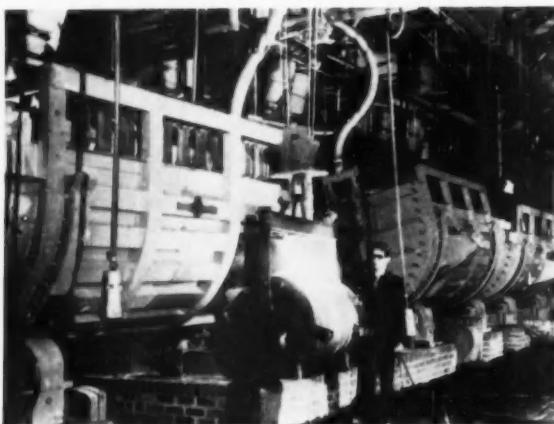
Manned by 1800 employees, mostly transferred from the existing Dagenham foundry, this fully-automated plant has a daily capacity of approximately 400 tons of finished castings, which represents about half the Ford output. It will manufacture heavy castings such as cylinder blocks, heads and

large tractor components, while the company's Dagenham and Leamington foundries will supply the remaining Ford requirements.

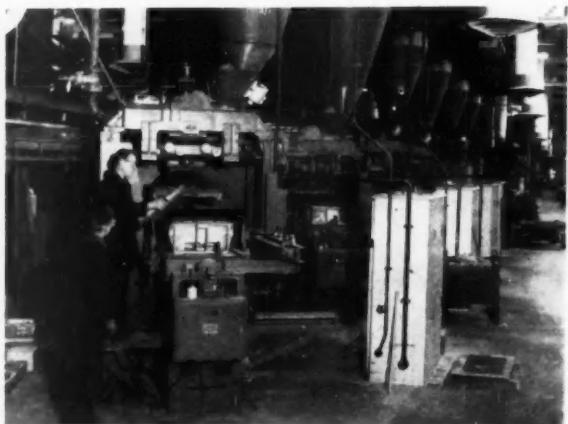
Measuring 1200 ft in length, 180 ft in width and 70 ft in height, the larger of the two buildings comprising the foundry houses the main foundry operations of melting, molding, coremaking and fettling. The 700 ft by 60 ft by 70 ft building contains the sand handling and drying, casting, cooling, grinding and cleaning sections.

For the operating floor in the main building, bays of 60 ft by 60 ft were chosen as the design basis and steel columns at 60 ft centers support lattice girders which form the fabric of the building. These are utilized for carrying much of the sand-system and monorail conveyor equipment, as well as the material storage hoppers, thereby eliminating individual supporting columns and providing maximum free working space at floor level.

Pig iron and coke reach the foundry by rail, and an automatic



Metal being transferred from one of the hot metal receivers into a 2000-lb capacity ladle from which castings are poured.



The coremaking line is equipped with six coreblowing and core stripping machine units on which various cores for tractor castings are made.

From the receipt of the undried sand to the ultimate usage of prepared sand for core and mold making the operation is completely automatic. By using push-button controls and signal lights of the type illustrated, operators can control and follow the passage of sand throughout the foundry.

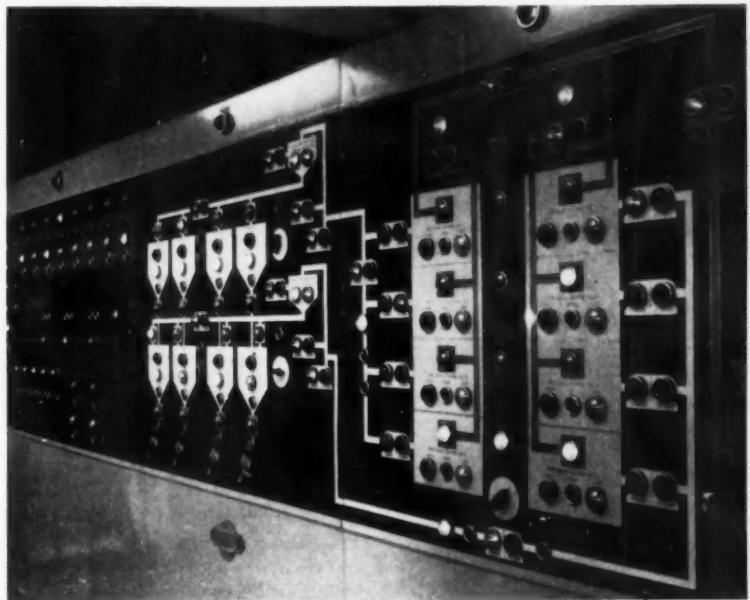
system with five-ton cars lifts the coke containers from the wagons and conveys it to storage hoppers adjacent to the cupola melting units. The same trolley system also handles the limestone.

Skip hoist machines load pre-weighed charges of pig iron, scrap, coke and limestone into four 108 in. diameter hot-blast, water-cooled cupolas, of which there are two for each working shift. There is one skip charger to each cupola and one hot-blast unit to each pair of cupolas. Each cupola has an eight-ton receiver which pours the hot metal into ladles. These are suspended from monorail supported electric towing and hoisting units to facilitate transferring the metal to the molds at the pouring stations. There are ten 2000-lb ladles for pouring for heavy castings and four 1000-lb ladles for pouring for other castings. Two six-ton capacity electric overhead cranes with magnets are used for loading cupola charge metals into the charging hoppers.

In addition to the foregoing, there is a 20-ton per hour pig-cast machine for "pigging" surplus metal.

The two molding lines are each equipped with four 50-ton/hr sand mullers and with smoke and fume collection apparatus. Each line incorporates eight semi-automatic molding machines, four cope and four drag, working within a continuous 800-ft mold conveyor of the latest pallet design. The molding machines are of the jolt-squeeze, straight through type. There are two 250-ton capacity sand storage hoppers and two 200-ton capacity sand conditioning plants, together with one slurry plant at a central station, from which is pumped coal dust and bentonite in slurry form to each sand muller.

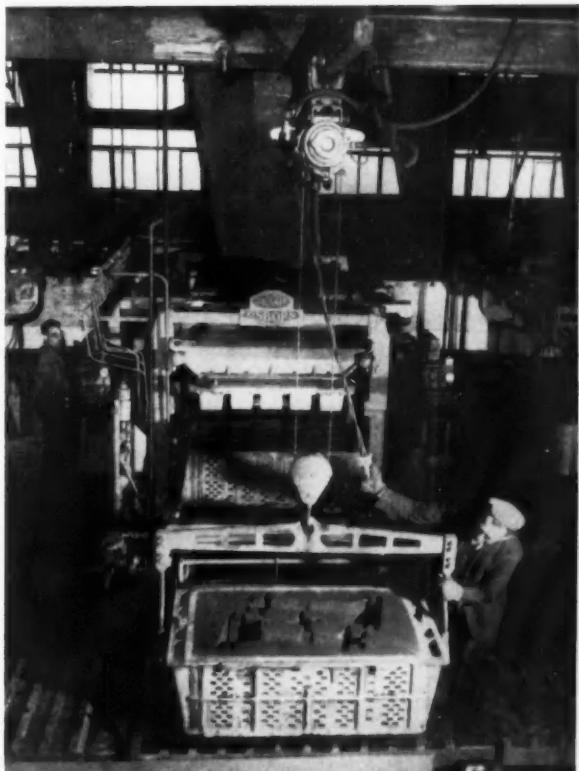
For removing the casting from

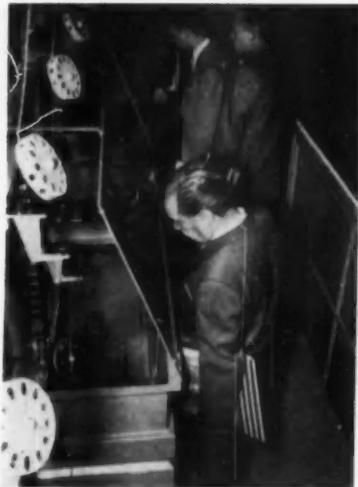


the dag mold special hook carriers suspended from a monorail (cooling) conveyor, located vertically above each mold conveyor, are used. The conveyor delivers them

to the smaller building where, after cooling for about three hours, they have the sand and cores removed by vibrators before being (Turn to page 63, please)

One of the 16 automatic molding machines used in the new foundry





The METAL SHOW in Review...

Visitors to the show displayed much interest in an operating demonstration of Du Pont's trichlorethylene finishing system

with particular emphasis on new or recently-introduced products.

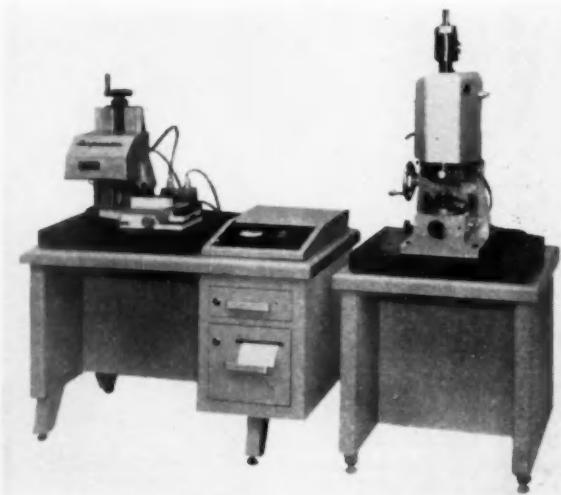
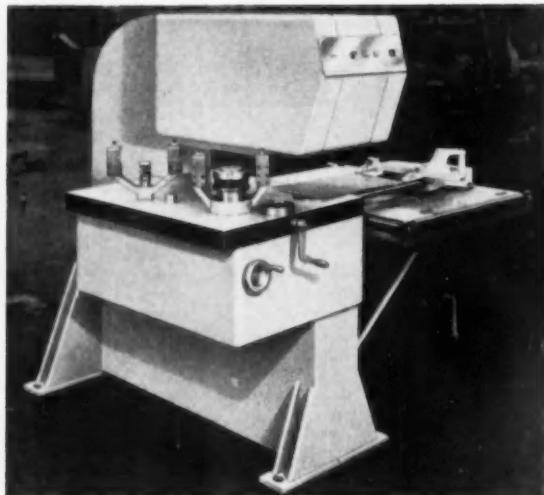
One of the most attention-getting exhibits was a working model of a machine designed and fabricated by G. S. Blakeslee & Co. It combines cleaning, phosphatizing, and painting in a continuous three-stage process using Du Pont trichlorethylene in each stage. Key element in the unique metal finishing system is a new phosphatizing process, which eliminates water solutions and applies protective phosphate coatings to metal parts at savings in equipment investment, floor space, and operating costs.

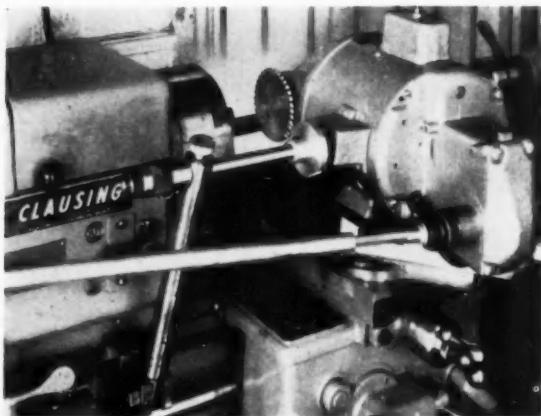
In the new process, metal parts are given a phosphate coating by dipping or spraying with a trichlorethylene-based phosphatizing solution maintained at its boiling point (188 F). After phosphatizing, as the parts emerge from the trichlorethylene vapor zone, the solvent completely evaporates leaving parts dry and ready for immediate painting. The new process, which will be commercially available in mid-1960, is now operating on a field trial basis at several locations, including the Chevrolet Tonawanda (N. Y.) plant. This installation will be the subject of a feature article in a future issue of AUTOMOTIVE INDUSTRIES.

In the heat treating field, Ajax Electric Co. displayed a new salt bath quench furnace, while Ajax Magnethermic Corp. showed a new static frequency converter. Ameri-

NEARLY 50,000 visitors to the 41st National Metal Exposition, held at Chicago's International Amphitheatre November 2-6, saw a glittering panorama of 400 exhibits featuring the latest developments in materials, equipment, and processes for the \$150 billion metalworking industry. Many of these were previewed in AUTOMOTIVE INDUSTRIES for November 1. Described below are additional highlights of the show,

The Proficorder, product of Micrometrical Mfg. Co., measures and records in microinches the surface profiles of workpieces. At left is the linear type, and at right the new rotary type, both usable in combination. The rotary-type mechanical-electronic device is for circular machined work pieces.





Fen-Lathe-Thread-Mill
Miller is a portable thread cutter for attachment to screw-cutting engine lathes

can Gas Furnace Co. was on hand with models of new controlled atmosphere, shaker hearth, and continuous rotary retort furnaces. Electric Furnace Co. displayed samples of continuous vacuum annealed strip of various metals and alloys. Hevi-Duty exhibited a new industrial tray-loaded oven.

Lindberg Engineering Co. featured a new pilot plant graphite tube furnace for temperatures up to 5000 F, an automatic ladling furnace, and a model of a gantry type drop bottom furnace for heat treating missile bodies and rocket motor cases. Models of other in-

dustrial heat treating and process line equipment were also included in the display.

Focal point of the Surface Combustion Corp. exhibit was a demonstration of its power convection principle for industrial treating equipment that is said to exceed any hot fan velocity previously used in the heat treatment of metal. By putting a "storm" into the furnace and increasing convection power appreciably, furnace size is decreased, processes are speeded up, and product uniformity and process control are greatly improved, according to the company.

Toeco Div. of Ohio Crankshaft Co. exhibited a new 30-kw motor generator and control in a compact unit with a portable work station, and a 15-kw, 450,000 cycle induction heating unit. The Electronics Dept. of Westinghouse Electric Corp. also showed its latest developments in induction heating equipment as applied to induction hardening of truck axle shafts.

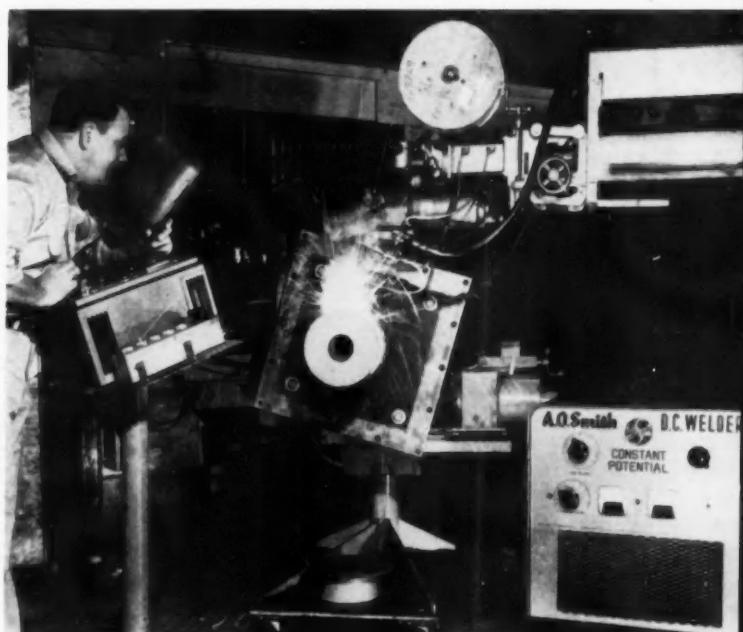
Protection Controls, Inc., featured the new Protectofer combustion safeguard control, designed for use with gas-operated burners in ovens, furnaces, boilers, and other heating equipment. Used in conjunction with the main controller is a series of plug-in sub-assembly called "Flame-Pak," each of which contains the electronic circuit for one burner. In case of a flame failure, the signal to the "Flame-Pak" is interrupted, and this in turn breaks the circuit to the safety shut-off valve and stops fuel flow to all burners in the system.

Leeds & Northrup Co. unveiled the firm's new Master-Slave Program Control System, designed for applications where temperature uniformity in a number of stages

(Turn to page 62, please)

CP C-O-Matic, a new CO₂ automatic welding equipment package introduced by Welding Products Div., A. O. Smith Corp.

Model 100 Winslo-Matic is a new precision drill point grinding machine offered by Winslow Product Engrg. Corp.



RADIOISOTOPES

Advance

in Automotive Engineering

By Arthur J. Stevens
President, Radiation Engineered Services

THIS article is a continuation of Part 1, which appeared in a recent issue of *AI*. Specific applications in the automobile and aircraft industries are described, as used by both the vehicle and aircraft builders and by the suppliers of the more important materials and components.

Generally speaking, the automobile industry proper has not made

as extensive use of isotopes as have its vendors. This is, perhaps, to be expected, as over the years the industry's primary function has been manufacture and assembly rather than production of raw materials—the area in which isotopes have enjoyed widest application.

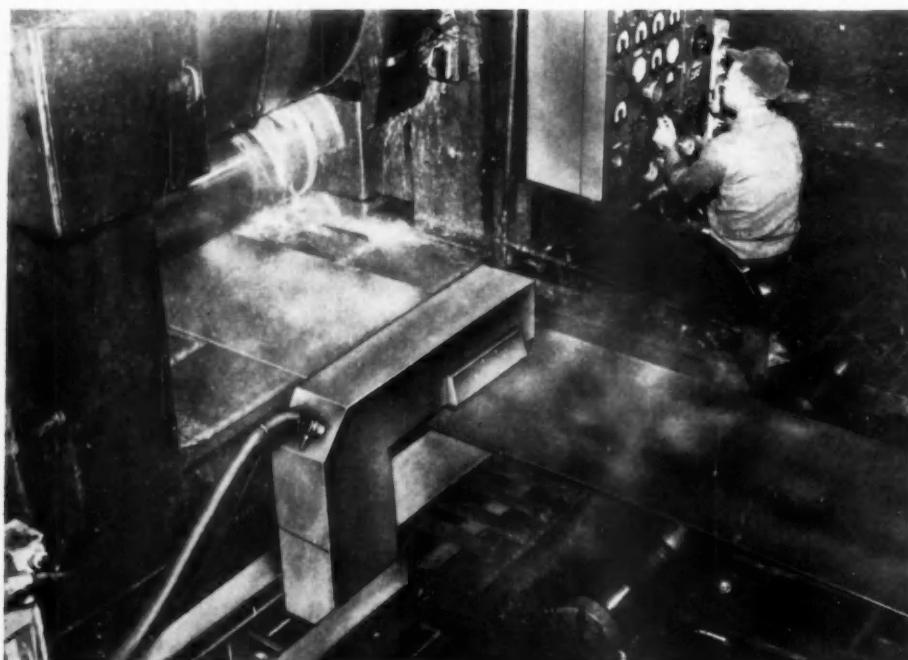
The aircraft industry, on the other hand, has appeared to make more direct use of isotopes within

the industry proper. Again this is not surprising, in that more rigorous specifications are usually met in the manufacture of aircraft, creating a constant and urgent need for better quality and production control techniques.

Both the automobile and aircraft industries, like all industry, are taking advantage of only a small fraction of the savings available to them through the use of isotopes. This situation will be remedied only by more extensive dissemination of proper information.

• RADIOPHGRAPHIC APPLICATIONS •

Isotope radiography is, exclusive of the use of radium, a relatively young field. Strong and inexpensive gamma emitting sources and associated handling equipment only became available commercially about 1952. In the intervening years, isotope radiography has grown to challenge x-ray for a position in non-destructive testing, but only a small fraction of the potential market has been reached.



PART
II

Fig. 1 — AccuRay system measuring and controlling strip thickness of cold rolled steel at Steel Division, Ford Motor Co.

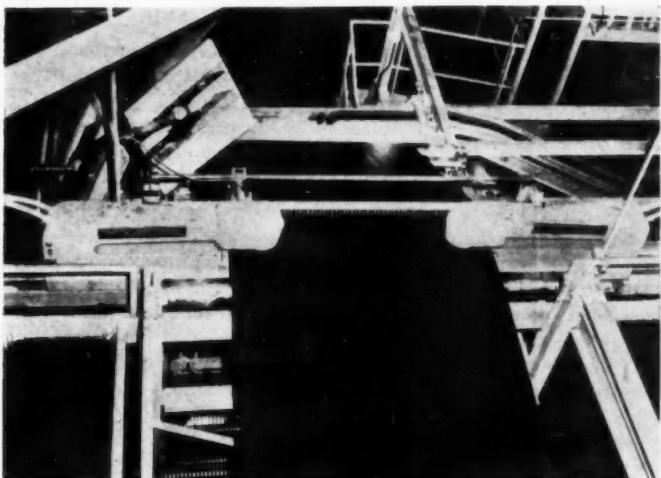


Fig. 2—Isotope gage continuously measures and controls area weight of tire fabric, which forms tire plies at B. F. Goodrich Co., Oaks, Pa.

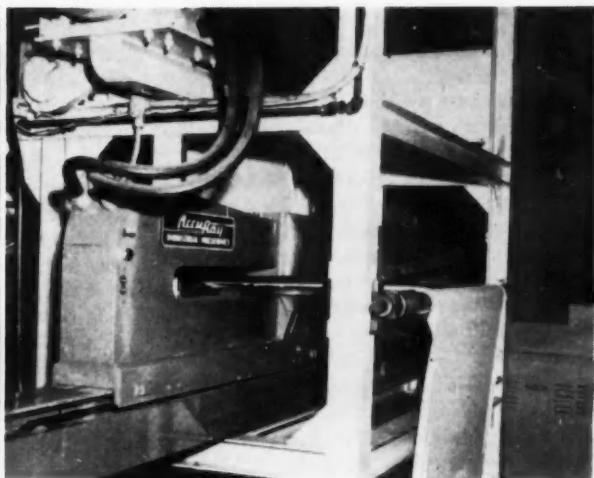


Fig. 3—AccuRay system at Columbus Coated Fabrics Corp., Columbus, Ohio, measures and controls coated fabrics to within extremely close tolerance limits.

Automotive Applications

Several applications of radiography in the automobile industry have been published.

The Steel Division of one of the "big three" has used isotope radiography for the inspection of 100-ton-capacity slag pots. The 30-ton containers showed external defects which were questioned by safety inspectors. A cobalt 60 source suspended in the center of the overturned pots allowed inspection in the field.

The same company used Cobalt 60 to inspect a large steel crank-shaft casting made in the jobbing foundry. Radiography permitted inspection for hidden defects before expensive machining operations, and thus provided a guarantee against potential losses. Similar applications of gamma radiography have been made by this company in the inspection of welds in high pressure steam lines in the power house, in the detection of cracks in crane hooks and trunnions on metal ladles, and even in the inspection of welds during the erection of an office building.

Gamma radiography may be applied to considerable advantage in the foundry producing engine blocks, brake shoes and other castings for automotive use. Judicious radiography during the run-in of a new pattern provides the metallurgist with pertinent information

concerning molding and pouring techniques, as well as indications of core shift or other difficulties during pilot runs.

While isotope radiography is limited in applications to thicker steel sections (usually above 0.1 in.) it is almost ideally adapted to the inspection of welds on the heavier chassis components. Spot radiography serves as a constant check on the efficiency of the welder, thus aiding in the maintenance of quality of production. Intelligent use of radiography can result in materials savings by eliminating metal from "over design" which was originally included as a safety factor provision for potentially poor welding.

Aircraft Applications

Isotope radiography, particularly with iridium 192 and the newer thulium 170, is especially well adapted to maintenance inspection of aircraft.

One of the large automobile companies, interestingly enough, has used isotopes to inspect stabilizer castings in the tail-wing sections of the company-owned Convair airplanes. These castings require structural certification every 200 hours of flying time. They are encased in the tail section, and cannot be visually inspected without time-consuming and expensive disassembly. Isotope radiography allowed

inspection on location with a considerable savings of man-hours required for the inspection.

Similar techniques are being applied by the air lines. Fatigue cracks can often be detected by radiography without disassembling structures. Isotopes here have two decided advantages over x-ray. First, the source of radiation is small enough (usually less than $\frac{3}{4}$ in. in diameter) that it can be inserted inside the structure and positioned in a strategic radiographic position not accessible to x-ray. Secondly, the wider latitude (in essence, the greater range of metal thickness that can be inspected on a single radiograph) of isotopes allows readable and meaningful pictures to be taken through a greater complexity of associated structure. In many cases radiographs can be made with isotopes that can be obtained in no other way. The obvious savings in labor of disassembly and reassembly for other inspection methods, can run into thousands of man hours per airplane.

Similarly, isotope radiography has been used in searching for broken pistons and rings in engines prior to disassembly and repair, and it has been used for the inspection of landing gear components on the Boeing 707 jet.

Although the missile field is young, it has already adopted ex-

tensive use of gamma radiography. Certain electrical and mechanical components of the Sidewinder are radiographed routinely with iridium 192 after assembly to assure correct assembly and alignment. Here again the wider latitude of isotope radiography is of value. And several of the solid propellant rockets—the Matador is an example—have been inspected for flaws or voids in the propellant, using cobalt 60.

The wide latitude, portability, lack of requirement for a power supply and versatility in location of source make gamma radiography almost ideally adaptable to many types of aircraft and missile inspection.

GAGING APPLICATIONS

Isotope gaging, since it is primarily a process control technique, has found its principal applications in the plants of basic material suppliers to the automotive and aircraft industries.

Automotive Applications

The steel industry has employed isotope gaging, particularly on cold rolling mills, for a number of years. The thinner sections encountered are within the range of the more common beta gages.

Most gages on the market today employ a gas filled detector, which, while quite sensitive to beta radiation, is relatively insensitive to the more penetrating gammas. As a result, the bulk of gaging applications have been with thinner sections and lighter materials. Gamma gages for thicker sections and heavier materials are in limited use, but usually represent a moderate to extreme extrapolation of the beta gage principles, and, as a result, are not ideally adapted to heavy section gaging.

For example, isotope gages are used on a three-stage tandem cold mill in the steel division of one of the large automobile companies. The gages scan the sheet and automatically control the thickness through servo controls on the mill proper. Steel 0.035 in. thick can be produced with tolerances of ± 0.001 in.

maintained continuously. Previous gaging often produced variations of up to ± 0.004 in. The greater uniformity of thickness and the resulting increased feet of sheet per ton of yield obviously result in large dollar savings to the company. See Fig. 1.

Thus, isotope gaging has been directly concerned with sheet steel for automobile, truck and bus bodies, with steel used in bearings and springs, and with stainless steel sheet used for trim.

A sheet steel gage could also be of considerable value to the shop producing body stampings. Used to check quickly and accurately the thickness of incoming steel sheet, it could prevent die damage in stamping operations. Carrying this concept one step further, it is conceivable that stamping presses could be developed that would utilize such a gage to adjust the press, from sheet to sheet, to the particular thickness being stamped.

Still within the steel industry, radioactive level gages have been used to determine the height of stock added to a cupola stack, and to detect liquid metal height in cupolas.

Of all the suppliers of automotive materials or components, the rubber industry has probably made widest application of isotope gaging. Gages have been used to increase ply uniformity through control of application of exacting quantities of protective rubber to tire plies. More uniform plies are translated ultimately into better balanced tires. Over 60 percent of all tire calenders now use isotope gages. See Fig. 2.

Similarly, calendering operations in the plastics and textile industries have resulted in more uniform coatings through the use of isotope gages. The result has been better upholstery materials for automobiles. See Fig. 3.

Isotope gaging is now widely used in the production of automobile batteries. One of the most difficult problems in battery production has been the continuous, dependable measurement and control of spongy, freshly calendered rubber used in making microporous

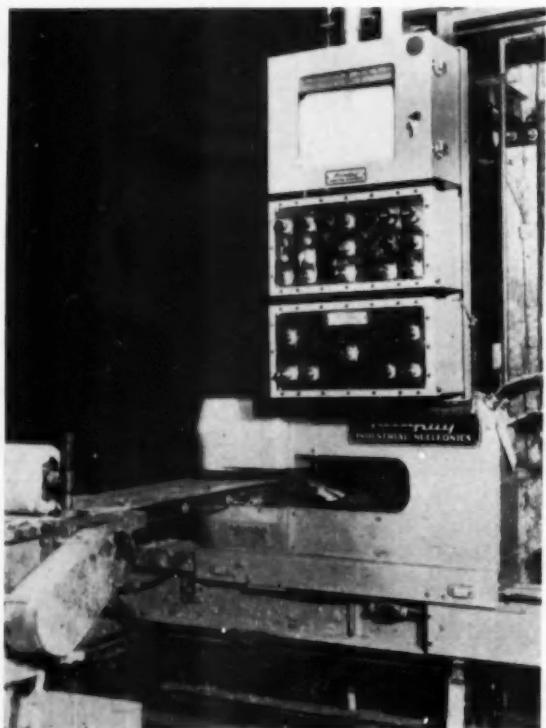


Fig. 4—AccuRay system measuring and controlling battery plate pasting process at Price Battery Corp., Hamburg, Pa.

battery separators. Isotope gaging gives extremely accurate measurement and control, prior to curing, of thickness with an error of less than one per cent. Operators, prior to the installation of gages, purposely held to the high side of thickness to avoid running scrap. The isotope gage permits thickness to be held very close to target, and with no danger of scrap production.

The production of batteries has also benefited from isotope gaging in the manufacture of battery plates. The high speed process of pasting lead oxide compounds to lead grids was largely uncontrolled before isotope gages were employed. Substandard plates are now virtually unknown as a result of one particular radioisotope application. See Fig. 4.

Another automobile component where gaging is applicable is safety glass windows. Both the glass and the inner plastic ply lend themselves to isotope gaging.

Of the materials in the modern automobile, over three quarters in weight and two thirds in dollar value are, or can be, improved in quality and produced less expensively through isotope gaging.

Aircraft Applications

Most of the applications described in the previous section also apply to the aircraft industry, to one degree or another. In addition, there are some other applications specific to aircraft and missile manufacture.

Sheet aluminum, like sheet steel, is susceptible to isotope gaging during production. Similarly, extrusion processes may be measured and controlled with isotope gages.

The production of milled skin for aircraft represents an area of gaging where isotopes should be superior to almost any other conceivable method. A continuous, instantaneous indication of thickness of section is of obvious value.

Considerable research has been conducted on the application of isotope gaging to fuel tank levels in aircraft. In principle, the fuel level would be determined by the mass absorption of radiation by fuel in the tank. The mass per unit area

measured may then be translated directly into inches of height, gallons or hours of flying time remaining. In practice, complexity of instrumentation has presented a problem.

At least two manufacturers of rocket engines are experimenting with a modified form of isotope gaging for the non-destructive testing of cast solid propellant. Radiography, while effective, is sometimes time-consuming and expensive, particularly with the larger engines. A narrowly collimated beam of gamma radiation can be used as a "probe" to sense flaws or voids in the propellant. A similar process is adaptable to a number of applications, especially where very thick sections are involved.

• TRACER APPLICATIONS •

Tracer techniques had been employed for a number of years before either isotope radiography or isotope gaging came into large scale use. Tracer experiments usually require relatively small amounts of radioactive material, compared with either radiography or gaging. Tracer work, then, was possible using cyclotron-produced radioisotopes, and did not have to await the larger quantities available only after the nuclear reactor was developed.

Automotive Applications

Perhaps the classic industrial application of tracer techniques was in the automotive industry—the study of piston ring wear. Certainly it received more extensive publicity than almost any other experiment. Briefly, an entire piston ring was made radioactive by inserting it for a period in the neutron flux of a nuclear reactor. Some of the atoms in the metal were made radioactive by the absorption of one neutron apiece. Use of the radioactive ring in an engine then allowed rapid and quantitative evaluation of the wear of the ring through detection and measurement of radioactivity in suspension in the oil.

Similar techniques have been used for a large variety of wear

studies—for tool bits, gears, sliding metal surfaces, wire drawing and steel extrusion dies, and even automobile tire wear. The number of experiments that have been conducted, and the results that have been published are too great in number even to list here. But all have utilized similar principles—the detection of extremely minute quantities of material when moved from one locus to another.

Tracer techniques have also been successfully employed in studies of metal cleaning and in applications of paints and other protective coatings. Unquestionably, some of the success of the new automobile paints is owed directly or indirectly to radiotracer experiments.

The rubber industry has been very active in tracer studies. Automobile tires have been made incorporating radioactivity that permitted tire wear studies. Tracers have been used in the study of the structure of neoprene, and in research on the oxidation of rubber.

The absorption of sulfur dioxide in cylinder zone oil films in Diesel engines has been studied using radiochemicals.

The tracer technique lends itself to corrosion studies (mufflers, tail pipes, spark plugs and points, body components, etc.), wear studies (brake linings and drums, engine components, etc.), as well as a whole host of other research projects. Anyone concerned with automotive research should be able to conceive of an almost unlimited number of possibilities.

Aircraft Applications

As was the case with gaging, most of the tracer techniques which are of value in automotive research apply equally to aircraft studies. A few applications specific to the aircraft industry (such as a study of the physics of mechanical removal of ice from aircraft) have been made, but by and large, the majority of projects would be common to the interests of both industries. ■

AUTOMOTIVE INDUSTRIES
KEEP YOU INFORMED

Welding—

Primary Production Method for Motor Vehicles

(Continued from page 46)

requirement. In addition, welding characteristics are not always satisfactory compared to three-phase rectifier type.

Multiple-operator equipment offers economies in both installation cost and operation in cases where there is a concentration of welders in a small area. Of course, where direct current is used (as it is for the most part), all welders must weld with the same polarity; individual circuits cannot be readily reversed.

This system uses a constant-voltage power source with a ballast resistor or reactor in series with the arc to regulate the current. In order to make the arc stable, the voltage of the constant-potential source must be higher than the arc voltage. This difference in voltage is absorbed by the ballast.

Welding current is controlled by varying the value of the ballast resistance on dc or reactance on ac. This, in turn, alters the degree of current required to produce the voltage drop in the ballast equal to the difference between the constant-potential source voltage and the arc voltage.

Power sources for multiple-operator installations may be rotating-type motor-generator sets, static rectifier units, or transformers. Ratings run from 600 to 2500 amp for the rotating machines, 500 to 1500 amp for rectifier-type units, and 500 to 2000 amp for transformers. It is customary to furnish a power source voltage of 70 to 80 v with arrangements for setting up two or more units in parallel for combined output.

SHIELDED METAL-ARC

Shielded metal-arc welding is a process in which coalescence is produced by heating with an electric arc between a covered metal electrode and the work. The electrode is melted and deposited in the weld; pressure is not used.

The shielding is composed of

minerals and other chemicals applied to the steel electrode, usually by extrusion, but occasionally by dipping. The melting and combustion of this coating in the arc protects the molten metal of the core wire in its transfer across the arc. It also provides ionizable materials for the arc and may, in some cases, contain alloying elements to furnish an alloy weld deposit with the core wire.

Control of three variables—speed of travel, amperage, and arc voltage—is the prime consideration in the use of metal-arc welding. The welder exercises control over the first and the third elements in manual welding, but in semi-automatic arc welding he controls only speed of travel. All three variables are preset, maintained, and controlled by a suitable device in a fully automatic process. Actually, coated electrodes have far fewer applications in semi-automatic and fully automatic welding than they do in manual welding.

The shielded metal-arc process is used for welding a wide variety of metal thicknesses and all alloys. It may also be used for arc cutting, a technique for producing relatively rough cuts in many metals. Since the heat is intensely localized and is obtained almost the instant the arc is struck, welding can be performed at a fairly rapid rate with little distortion.

There are many applications for shielded metal-arc welding in automotive manufacturing. A few examples are: steering column supports; radiator cradles; front fender support brackets; front tie bars; bumper sections; frame and body; and miscellaneous small parts.

Equipment

Shielded metal-arc welding may be performed with either direct or alternating current using covered electrodes; only direct current may be used with bare or lightly coated

electrodes. The choice between a-c and d-c equipment depends on the metal to be joined, thickness, position of the weld, electrodes available and, of course, on relative equipment size, cost, and maintenance.

D-c equipment is more versatile and can be used for welding both ferrous and non-ferrous metals. A-c shielded metal arc welding is limited to carbon steels, low-alloy steels, and stainless steels, although some aluminum bronze electrodes are available for a-c use. It does, however, have an advantage in its lack of arc blow, a factor which makes weld uniformity easier to obtain and provides deeper penetration.

Aside from a source of welding power (a-c transformer, d-c generator, a-c generator or rectifier), a number of welding machine accessories, such as oscillators, voltage protective devices, remote control units, etc., are used in manual shielded metal-arc welding operations. In addition, such auxiliary equipment as cables, electrode holders, weld gages, etc., is employed.

Part II of this four-part article will appear in an early issue of AUTOMOTIVE INDUSTRIES. ■

S-p-e-e-d C-h-e-c-k

Tech List WELDING

For the items below check number listed for each item on the business reply card at back of the issue

Post-heat Treatment 1

A chart containing a summary of recommended arc welding procedures for various steel and B. & W. croloy combinations covers 19 types of steel and croloy. There are also 17 different electrodes listed, and an easily read code chart on pre- and post-heat treatment. The electrodes are numbered for association with the main, and code charts. *The Babcock and Wilcox Co.*

Welder Schematic 2

A schematic diagram, complete with optional equipment, is shown in

a detailed two page insert in Airco's brochure. Charts, graphs and technical data are included in this literature also. *The Air Reduction Sales Co.*

Three-Phase Charts 3

Capacity charts, designed for quick reference on three phase spot and projection welding machine operations, utilize recommended practices of the AWS and technical data on steel, stainless steel, aluminum and other light alloys. This litera-

ture also covers fuse rating-amps, secondary amps, ignitron tube size, electrode stroke and net weight of these machines. *Sciaky Bros. Inc.*

Spot Welding Control 4

A brochure describing the new Budd "Monautronic V-2" covers all the features of this quality control unit. It includes information on: automatic sequencing, transistorized design, modular construction, shock resistance construction, safety interlock and tamperproof case. Specifica-

tions, optional equipment and other general data are covered. *The Budd Co.*

Welding Wire Charts 5

Specifications, applications, conformance and procedures are discussed, concerning aluminum, stainless, copper and steel welding wires, in a pocket size booklet. This booklet contains many quick reference charts and tables on these subjects. *The Air Reduction Sales Co.*

Observations

By Joseph Geschelin

Teflon Bearings

One of the brightest facets of diversification at Micromatic Hone is its Fabroid division on the West Coast, specialists in Teflon bearings. They have developed a special way of making bearings of many kinds in such fashion that Teflon lines just the journal surface and is firmly bedded in a strong plastic formulation with glass fibers. We are told that Fabroid bearings are used extensively in military and commercial aircraft, helicopters, and in missiles. Teflon is a slippery material that does not require lubrication and is comparatively unaffected by dirt or temperature changes. One of the heavy duty engine builders is in the process of testing a set of engine main bearings supplied by Fabroid. If this works out consider the possibilities: for one thing, if connecting rod bearings as well as mains were of Fabroid, we can see the feasibility of simplifying engine details to eliminate full pressure lubrication to the crankshaft.

Applying Electronics

Micromatic Hone has taken a leap forward in basic research through the use of multiple-channel electronic recording equipment. Where

testing of new techniques has involved tedious laboratory work, involving a large number of instrument readings repeatedly with changes in variables, equipment such as Sanborn 150 makes it possible to get simultaneous readings of all criteria with great rapidity. Now this is not new to the tech centers in the automotive industry but it is new in the machine tool field where only a few have had such facilities.

Market Changes

Best indication of the difficulty of appraising market trends is what has happened in connection with the new small American cars. Up to the time of their introduction there was a belief that the crop of small cars was being launched in an effort to stem the tide of imports. Now that market analysts have had their say at the various press meetings we have been given an entirely different interpretation. No one is sure now that much of a dent will be made in the flow of imports. It has been variously estimated that imports for the year may run as high as 600,000 units. No one predicts that this volume will be seriously affected; or if it is then only by 50,000 or 100,000 units at the most.

Where then is the market for the small cars? The consensus is that the demand will come from new buyers, used car buyers, and second car buyers. Actually, if the small cars go over in a big way they may make inroads on the lower priced cars of the same family or of competition. It adds up to a waiting game. In another six or nine months the record will show what happened. And depending on the record there may be a further realignment of thinking which may eliminate some members of a car family. The only makes that are safe are those in the high priced brackets. Consensus is that sales of Cadillac, Lincoln, Continental, and Imperial should be relatively unaffected by shifts in buying habits.

Molded Iron

An exhaustive investigation of the variety of factors involved in a machinability study is outlined in full detail in the October, 1959, issue of the *Eaton Engineering Forum*. It deals with the machinability of Eaton permanent mold gray iron castings.

AUTOMOTIVE INDUSTRIES
KEEP YOU INFORMED

The METAL SHOW

in Review...

(Continued from page 55)

of processing is of prime importance. It is already being used in the brazing of stainless steel honeycomb panels for aircraft. As many as 24 zones may be automatically controlled by one Master-Slave Programmer. The system is available both for control of gas-fired furnaces and for control of input to electric heaters.

A new coating for preventing scale formation on metals during heat treatment was announced by Navan Products, Inc., subsidiary of North American Aviation, Inc. Called Skalix, the material is applied by spraying or dipping, and adheres to the metal at furnace temperatures to form an oxygen-tight seal. Then when the metal cools the coating spalls off by itself, requiring in many cases, no further processing. Applications include stainless steel, nickel-chrome alloys, cobalt alloys, copper alloys, and new exotic alloys now under development.

The growing science of powder metallurgy came in for its share of attention in a booth occupied by the Metal Powder Industries Federation. On display were a wide range of powder metal products, including a number for the automotive industry. One of the leaders in this field, Amplex Div. of Chrysler Corp., exhibited new Oilite powder metal parts, bearings, and filters. Featured was the new Iron Oilite 212 bearing, comprised chiefly of iron powders with approximately 20 per cent oil content. Suggested uses include bearing and bushing applications on home appliances, fractional horsepower motors, power tools, light machinery, instruments, light vehicles, communication equipment, and other products. The new Iron Oilite 212 bearings are now available in production quantities from Amplex in sleeve, flange, and spherical form.

A high point of interest in the welding field was the booth occu-

ped by A. O. Smith Corp., in which demonstrations of its new equipment for automatic and semi-automatic CO₂-shielded welding processes were demonstrated. The processes can be used on a wide range of gages from about 0.075 in. to 1½ in. plate, on fillet, lap, butt welds, or for steel casting repair. The new CP C-OMatic equipment consists of a 600-amp constant-potential power source, control panel, and fully automatic welding head.

Another welding development of interest, unveiled at the show by NRC Equipment Corp., was the new Model 2405 electron beam welder for precision welds in reactive, refractory, and other high performance materials. It is also said to make possible fusion welding of items previously considered unweldable, including heat-sensitive assemblies, dissimilar materials such as aluminum and steel. Vacuum brazing, sintering, heat treating, and melting of small charges are additional applications.

Texaco, Inc., exhibited a line of new soluble oil heavy-duty lubricants. Among these was its new series of Cleartex oils for automatic screw machines. They are said to serve equally well in the lubrication, cutting oil, and hydraulic systems of automatic screw machines.

In addition to a presentation of new explosive metal-forming techniques, Chromalloy Corp. showed a number of products coated with its alloy diffusion process to resist corrosion, wear, and oxidation. Among these was a line of high-performance sprags for FormSprag overrunning clutches. The chromalized sprags are currently being used in Clark Equipment Company's new Step-Matic transmission produced for the trucking industry.

The new rotary Profcoorder was the attraction at Micrometrical Mfg. Co.'s contribution to the show. This is a mechanical-electronic de-

vice which provides a magnified chart record of the shape, height and spacing of surface irregularities of circular machined parts. Height readings are in microinches.

Kodak Metal-Etch Resist, a light-sensitive, etch-resisting plastic coating for chemical etching and milling, was pictured in the Eastman Kodak Co. booth. New this year, the material was designed for use in the chemical processing of steel, aluminum, titanium, nickel, and magnesium, etc.

A new barrel finishing media, designed especially for zinc die castings, was emphasized in the Minnesota Mining and Manufacturing Co. exhibit. Called "Honite" brand Z-N Tumbling Shape, it is said to offer fast cut-down, produce a low micro-inch surface, and protect workpieces against surface impingement.

Automatic finishing equipment and a new airless spray-painting system were featured by Binks Manufacturing Co. In operation was a vertical rotary sprayer consisting of eight guns having a spray area of three to nine feet. This device is adaptable for use with the Binks' Memory Timer, an electro-mechanical unit which provides automatic spray finishing of different-size parts on a moving conveyor.

The DeVilbiss Co., in an extensive display, showed more than 50 different spray guns for manually or automatically applying various types of liquids, mastics, adhesives, and finishing materials. This exhibit also contained the company's new airless spray equipment, and equipment for spraying urethane foams.

New automatic cutoff saws and a new small precision surface grinder were operated in the large DoAll Co. exhibit. Electrolytic grinding and laboratory testing of cutting tools, as well as stainless steel gage blocks and new electronic comparators, were also among the many featured items.

Electrical-discharge machine tools were exhibited by several builders, pointing to the fact that interest in this type of equipment is growing. Elox Corporation, for example, had in operation its new M-660 machine, equipped with hy-

draulic power feed and new NPS-60 power supply, forming the cavity in a forging die. Also on display was the new Elox RP-100 machine, likewise equipped with hydraulic power feed, designed for precision-machining of three-dimensional cavities, multiple-pierce dies, extrusion dies, cold-heading and powdered-metal dies.

Die-casting equipment was featured by Kux Machine Co., which exhibited a 200-ton continuous-cycling hot-chamber unit, one of 28 new models. This machine can operate at speeds on the order of 900 cph; and can produce a six-pound zinc die casting at 1800 psi injection pressure.

The latest addition to American Pullmax Co.'s line of universal shearing and forming machines was shown in operation. Called the Pullmax U-10, this unit has a cutting capacity of $\frac{3}{8}$ -in. in mild steel when shearing, and is also usable for beading, dishing, edge bending, and louvering. The U-10 has pneumatic remote controls to raise and lower the cutting head.

Extended life of coolants and cutting fluids was the theme of Eli Lilly and Company's presentation. This company has a new bacterial inhibitor, called Elcide 75, which when added to the emulsions is said to increase their useful life up to five and one-half times.

Wales-Strippit, Inc., introduced a new deep throat model of its Strippit Fabricator at the exhibition. Named the Super 30 Fabricator, the machine is a single-station, high-speed punch press with a throat depth capacity of 30 in. Hole punching capacity ranges from $3\frac{1}{2}$ in. in 16-gage mild steel, to $\frac{1}{2}$ -in. in $\frac{1}{4}$ -in. mild steel, with a tolerance of ± 0.005 in. It will also do notching, straight line nibbling, and contour shearing.

Free-machining materials, in a diversified line, comprised the major show offerings of Joseph T. Ryerson & Son, Inc. Fast-machining steels on display included carbon, alloy and stainless types with data on latest developments in these fields. Also shown were 2011-T3, said to be the best machining of all aluminum rod, and cast aluminum tooling plate. Rounding out the display were free-machining plastic

bar and plate stock, being sold under the trade name of Ryertex-Omicron PVC, which machines like brass and is applicable where corrosion-resistance is a major consideration.

A new automatic drill point grinding machine was the main display of the Winslow Product Engineering Corp. Known as the Model 100 Winslo-Matic, the machine grinds drills from 0.032 through 1.5 in. diam, including types such as Winslow 4 drill points and other self-centering points, as well as conventional points.

Ultrasonics played a big part in the show—in cleaning equipment, non-destructive testing equipment, and in grinding machines. Sperry Products Co. introduced three new

ultrasonic instruments for non-destructive industrial testing. One is a portable thickness gage, battery-operated and wholly transistorized, that uses the pulse echo method in detecting changes in metal thickness of parts being inspected. Another is the UM Reflectoscope which provides flexibility in flaw detection setup through the availability of interchangeable plug-in units.

All in all, the National Metal Exposition this year was a tremendous one in which many new products, processes and materials were placed on view for members of the metalworking industry in carrying out the show theme, "Materials and Fabrication Preview of the Soaring '60's." ■

Ford's New Foundry in Britain

(Continued from page 53)

passed through a battery of grinding machines which remove any metallic surface irregularities.

Next, the castings are returned to the main foundry building by two further monorail type conveyors for the cleaning operations and, finally, to eight fettling lines for finishing, and, where required, for water test.

In the sand department, there is one 35-ton capacity wagon tipper and two $12\frac{1}{2}$ -ton/hr capacity sand driers, serving one dry sand supply system and one wet sand conveyor system. From the receipt of the undried sand in railway wagons to the ultimate usage of the prepared sand for core or mold making, the operations are completely automatic. By the use of systems of push-button controls and signal lights, operators can control and follow the passage of the sand throughout the foundry.

Cores are formed and baked at least 24 hours ahead of the molding process. The core-shop is centrally located in the main building and conveniently arranged in order to supply cores as required for each molding line. The core sand is mixed at a central high-level station. This operation is com-

pletely automatic and is actuated by the insertion of a punched card, one for each type of sand mix, into the weighing system. The mixed sand is conveyed by two pneumatic systems, which are the only ones of their kind outside the U. S. A., to the core-making machines.

All the cores are made by 39 semi-automatic vertical core-blowers, which force the sand mix into coreboxes producing the various types of cores required. The cores then go by conveyor to five continuous horizontal ovens for baking. These are built at an elevated level to facilitate operations and to provide storage space beneath. After delivery from the ovens, the cores have their external faces coated with a special wash to protect them from the molten metal. This wash is dried in three horizontal core-wash drying ovens. Nine core-grinder machines remove surplus sand where required.

The steam and gas mains for the new foundry as well as the electric power cables are all brought by way of a common trestle-way from the company's power house and coke ovens, a distance of about half a mile. ■

SAE

- Transportation,
- Diesel Engine, and
- Fuels and Lubricants

MEETINGS

NEW engines, new materials and new techniques held the attention of automotive engineers at the combined Transportation, Diesel Engine, and Fuels and Lubricants Meeting of the SAE in Chicago, October 26-30.

Speaking on the subject of aluminum high output, high-speed Diesel engines, R. F. Schaefer, Aluminum Company of America, said that the use of aluminum for high-speed rotating parts has been increasing rapidly in recent years. New methods of fabrication have been developed and evaluated by spin testing. These parts have been made as sand castings, permanent mold castings, semi-permanent mold castings, die castings, plaster castings, forgings, brazed assemblies and premium strength castings. A premium strength casting may be defined as a casting made by a process in which the best techniques have been engineered to a particular casting geometry during fabrication in order to produce a high quality product having exceptionally uniform, high mechanical properties. It may utilize any conventional or combination of conventional processes. Heat treatment wherever applicable is used to improve mechanical properties.

As Diesel engine components are stressed higher, the need for higher quality castings becomes paramount. This also means that care in the design and selection of alloys and heat treatments will be required.

The use of aluminum for the major components of liquid cooled and air-cooled Diesel engines is coming into increased acceptance in commercial as well as military applications. The thermal characteristics make it a very acceptable material for the high output turbocharged engine.

The production cost savings realized in tooling, machining and handling, along with the availability of aluminum, make it a very at-

tractive material for high output, high speed and lightweight Diesel engines, according to Mr. Schaefer.

A. F. Dewsberry, C. P. Bozos, and J. B. Reeves, Jr., Construction Equipment Division, International Harvester Co., presented a paper on International Harvester high-speed lightweight Diesels. In summary they said, "We believe that our initial goal of lightweight, high-speed Diesel engines of lowest possible cost has been more than fulfilled. In fact, applications not originally contemplated for these engines have been successfully made and more are being found. These Diesel engines weigh as little as 7.8 lb per horsepower.

A paper entitled, "Automatic Transmission Fluids Low Temperature Viscosity Studies" was given by R. E. Crosthwait, Supervising Technologist, and W. F. Greenawalt, Research Technologist, Research Department, Socony Mobile

Oil Co., Inc. They said that automatic transmission fluid low temperature Brookfield viscosities are being used to evaluate fluid performance under the extreme cold conditions occasionally encountered by the motoring public. Laboratory use of the Brookfield technique to study automatic transmission fluid component effects has indicated the following: Automatic transmission fluid low temperature viscosity behavior is best studied in fully formulated blends that contain all of the components of the balanced fluid. Lighter viscosity base oils offer the best low temperature fluidity. Equivalent automatic transmission fluid viscosity characteristics can be obtained with widely different mineral base oils. V.I. improvers are one of the major factors controlling low temperature viscosity. Detergents, anti-oxidants, and antisquawk agents have a minor additive on viscosity. In general, they increase the viscosity of the base oil—V.I. improver combination.

It cannot be overemphasized that design of a balanced fluid must consider all fluid performance areas—low temperature fluidity, shear stability, oxidation stability, lubricity, rubber compatibility, and foam. ■

COMPUTER Cuts Costs at Bendix

By Kenneth Rose

MID WEST EDITOR

USE of a computer for processing data from many sources on a missile contract has cut clerical costs in half, with additional savings expected, reported Richard F. Hamaker, manager of Data Processing for Bendix Products Division, Bendix Aviation Corp., at the Computer Applications Symposium in Chicago, Oct. 28-29. By devising a system that would process data of many kinds, no single

application of which was large enough in volume to warrant use of a computer, it was found possible to make the saving.

A missile contract, with all major components subcontracted, involves a flow of information through the plant from sales to engineering to production to test, and so on. Integration of these data into a single system for recording, updating, copying, and summarizing information from many geographically separated sources was the task of

(Turn to page 86, please)



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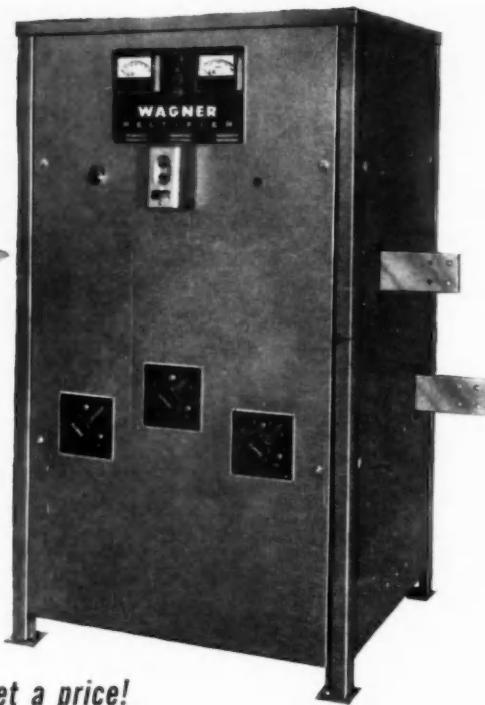
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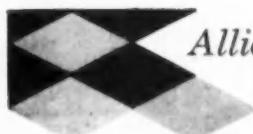
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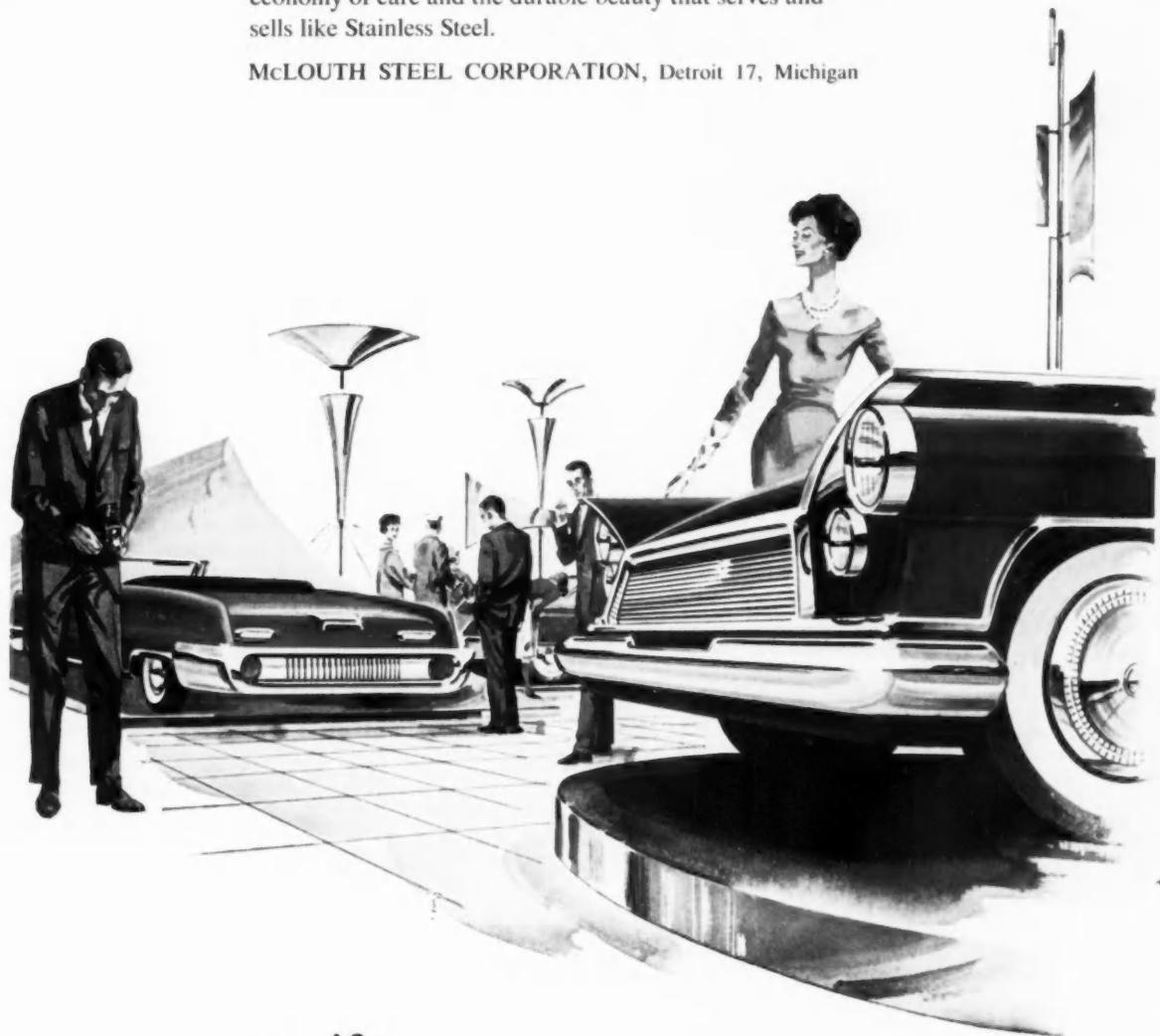
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Magnetic particles have to be bonded uniformly over tape length to precise thickness. Hycar was selected for its stability, excellent adhesion and good binding qualities. Since tapes undergo frequent use and often have to be stored for long periods, the long wearing and good aging characteristics of Hycar are also important.

Here's another example of the way Hycar helps improve a product or makes possible new applications. Get more information by writing Dept. CK-5, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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AUTOMATION NEWS REPORT

AUTOMATIC CONTROLS

PRODUCTION—VEHICLES—AIRCRAFT

By Samuel Cummings

MACHINE RESEARCH

At Western Reserve University, an electronic machine called the Searching Selector scans a "library" tape and produces a bibliography on a given subject.

CATE, a machine built by International Business Machines Corp. for the Air Force, maintains a continually updated punched card file on every scientist who ever headed an Air Force research project. When a major technical question comes up, the machine scans a name card deck to find the scientist with the right qualifications to be consulted.

Similar IBM machines that process information and then retrieve it now are working for such large organizations as Esso Research & Engineering, Dow Chemical, Union Carbide, Monsanto Chemical, Bakelite, and Socony Mobil Oil.

New Breed of Electronic Machines

All these machines belong to a new breed of electronic devices designed to keep track of the mounting volume of scientific and technical research—and make it available in a hurry.

The need is an urgent one. Great masses of important research data are piling up here and abroad. Scientists, unable to keep up with more than a fraction of this vast flow, are finding it virtually impossible to get at the known facts bearing on a specific problem.

What we are witnessing, research specialists say, is a breakdown of communications in science, technology, and other fields of knowledge.

Publishing Statistics

The magnitude of the problem can be seen from some of the statistics of publishing. There are 55,000 journals of science and engineering. Over 60,000 books are published annually. In one year, over 100,000 abstracts were published in chemistry alone. It is estimated that this literature—scientific and engineering—doubles every eight years.

Jesse H. Shera, dean of Western Reserve, summed up the plight of the research worker in a memorandum to the Senate Committee on Government Operations.

"Until quite recently," Dean Shera said, "it has been axiomatic that a project should begin with a review of the literature in order to provide the basis for research planning and to avoid duplicating previous work. Previously recorded knowledge was considered the most important single tool of the investigator. But today the rapidly expanding research facilities of Government agencies, universities, and industry have been pouring forth a cascade of new knowledge so great that existing arrangements for collecting and organizing records can no longer control the flood."

Searches Are Too Costly

The cost of making literature searches has pyramidized. According to the executive of one large steel corporation, it is cheaper to do a research job over again if the cost isn't over \$100,000 than to pay for a search to find out if it has been done before.

And Ralph O'Dette, of the National Science Foundation, citing the difficulty of keeping up with

foreign publications, has reported a case where the belated discovery of one important paper (Russian) "caused \$250,000 to be wasted in duplicating the work it covered."

To tackle the problem, information specialists have come up with a new concept which IBM calls "coordinate indexing." The aim is to develop a vocabulary of "keywords" to pinpoint the information sought instead of cataloging the material by subject and title.

Under this concept, each document is analyzed for keywords that characterize its contents. Access to the information is gained by querying the file through one or more keywords. Only these documents with keyword combinations matching those in the query are picked out by the machine as references.

How System Works

The Western Reserve Searching Selector offers a good example of the new technique at work. Installed at the school's Documentation Center, it has demonstrated the feasibility of searching literature by machine.

The Center's chief outside sponsor from the start has been the American Society for Metals and for this reason the present program is concentrated mainly on metallurgy. Here is how the system works:

The Center's staff prepares detailed abstracts of important articles from journals from all parts of the world. The abstracts are encoded into machine language, punched into standard IBM cards and also automatically punched onto paper tape.

The rolls of tape, stored in small boxes, constitute the Center's library of abstracts (in machine language) of thousands of scientific journals.

To supply a request for a search, the staff first translates the question into encoded keywords, which are then used to program the searching selector. Library tapes are then run through a Flexowriter, which sends impulses to the selector. The machine scans the

(Turn to page 93, please)

• • INDUSTRY STATISTICS • •

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending		Year to Date	
	Nov. 14	Nov. 7	1959	1958
PASSENGER CAR PRODUCTION				
Total - American Motors	8,681	8,767	342,463	173,743
Chrysler	1,269	1,342	60,965	42,647
De Soto	465	583	38,374	31,451
Dodge	6,622	6,445	161,307	99,517
Imperial	588	594	18,792	10,588
Plymouth	7,788	7,949	368,227	320,788
Total - Chrysler Corp.	16,730	16,913	647,885	504,951
Edsel	56	43	29,586	16,062
Ford	26,457	23,590	1,315,458	835,842
Lincoln	776	920	24,788	20,935
Mercury	2,921	2,106	134,054	96,699
Total - Ford Motor Co.	32,210	26,689	1,504,886	969,538
Buick	833	2,043	209,201	104,224
Cadillac	126	126	126,651	100,910
Chevrolet	2,501	6,421	1,300,059	998,807
Oldsmobile	72	72	337,192	246,446
Pontiac	120	120	360,273	165,624
Total - General Motors Corp.	3,526	8,484	2,342,376	1,701,511
Total - Studebaker-Packard Corp.	3,341	2,648	134,751	38,912
Checker Cab	217	164	4,060	2,593
Total - Passenger Cars	64,705	63,615	4,976,201	3,396,248
TRUCK AND BUS PRODUCTION				
Chevrolet	2,692	3,905	304,708	223,617
G. M. C.	259	248	70,783	51,162
Diamond T	64	51	4,802	5,018
Dodge and Fargo	80	80	3,316	2,582
Ford	64	422	66,406	47,974
FWD Corp.	4,654	3,755	296,532	201,002
International	20	19	1,334	1,127
Mack	2,565	2,455	128,185	78,781
Studebaker	291	291	18,285	12,485
White	414	402	10,984	8,603
Willys	340	1,933	99,564	78,270
Other Trucks	56	50	3,228	2,712
Total - Trucks	11,498	13,648	1,022,394	729,482
Buses	45	25	2,083	2,761
Total - Motor Vehicles	76,248	77,288	6,000,678	4,123,491

* - Plymouth includes Valiant, Ford the Falcon, and Chevrolet the Corvair.

NEW FOREIGN CAR REGISTRATIONS

	SEPTEMBER	
	1959	1958
Renault	9,439	5,828
Volkswagen	8,654	5,147
English Ford	3,553	3,470
Fiat	3,519	2,251
Opel	3,374	2,192
Simca	3,041	1,652
Hillman	2,447	1,767
Triumph	2,135	1,737
Vauxhall	2,130	1,736
MG	1,658	1,692
All Others	13,837	9,614
Total	53,787	37,268

FIRST NINE MONTHS

	1959	
	1959	1958
Volkswagen	82,755	58,422
Renault	65,244	31,709
English Ford	33,167	23,093
Opel	29,847	14,338
Fiat	29,454	12,768
Simca	28,688	12,522
Hillman	22,330	12,299
Triumph	18,049	12,138
Vauxhall	17,264	11,985
Volvo	14,215	10,478
All Others	114,489	86,167
Total	455,502	265,919

TRACTOR SHIPMENTS

WHEEL TYPE

Hp Ratings	September	Nine Months
9-29 belt hp	1,961	17,540
30-34 belt hp	3,883	26,223
35-39 belt hp	2,879	33,096
40-49 belt hp	3,518	32,584
50-54 belt hp	3,738	35,261
55-59 belt hp	1,157	22,625
60 belt hp and over	2,368	32,442
Total	19,482 ¹	201,771 ²

TRACKLAYING TYPE

Under 50 drawbar hp	1,405	11,818
50-74 drawbar hp	504	3,862
75 drawbar hp and over	1,391	11,940
Total	3,300 ³	27,618 ⁴

¹ Valued at \$41,372,000.

³ Valued at \$32,789,000.

² Valued at \$447,701,000.

⁴ Valued at \$268,361,000.

1959 NEW REGISTRATIONS

Arranged in Descending Order According to the Nine Months, 1959 Totals

NEW CARS

Make	Nine Months		
	September 1959	August 1959	September 1958
Chevrolet	112,909	137,937	86,149
Ford	106,151	128,414	68,014
Pontiac	29,174	34,455	13,099
Plymouth	27,765	34,099	22,099
Oldsmobile	27,059	29,223	16,684
Rambler	27,789	33,182	11,211
Buick	14,723	17,655	16,260
Mercury	12,447	12,683	10,065
Dodge	11,073	12,485	9,626
Cadillac	9,201	10,582	7,767
Studebaker	8,010	10,393	2,861
Chrysler	4,907	5,179	4,267
De Soto	3,323	3,665	3,398
Edsel	3,122	2,930	1,833
Lincoln	1,892	1,794	1,669
Imperial	1,002	1,104	884
Misc. Domestic	141	239	330
Foreign	53,787	56,187	37,266
Total - All Makes	457,285	532,279	321,224
	4,635,346	3,473,050	

NEW TRUCKS

Make	Nine Months		
	September 1959	August 1959	September 1958
Chevrolet	21,960	29,482	19,368
Ford	27,671	27,793	18,115
International	9,325	9,875	8,068
G. M. C.	6,274	6,069	5,213
Dodge	3,573	4,699	2,676
Willys Truck	1,756	1,615	1,312
White	1,419	1,259	958
Mack	1,159	981	1,131
Willys Jeep	976	882	786
Studebaker	516	541	298
Diamond T	262	265	226
Brockway	121	105	106
All Others	3,772	3,671	3,417
Total - All Makes	78,784	88,137	61,674
	530,085	725,211	530,085

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News of the MACHINERY INDUSTRIES

By Charles A. Weinert

Parts Honed in Stacks Using New Techniques

On the occasion of a recent press conference in Detroit, Micromatic Hone Corp. officials directed attention to a modernized version of "stack honing."

Basically, the idea consists of stacking a number of workpieces adjacent to each other and honing them as though they were one long part.

The new approach, called "horizontal stack Microhoning," has been developed primarily for cast iron and soft steel parts. It is said to be most effectively applied to narrow-width parts, such as rocker arms.

High rates of output and improvements in quality, as well as reduction in costs of equipment and abrasive, are stated to be attributes of the new process.

The tool employed in the single-spindle machine is of a special

guided type. It has plastic guides for positioning the workpiece before the stones pass through — similar to a design used by Micromatic in the past on interrupted bores. Since the stack of workpieces may be considered to be one interrupted bore, this type of tool has been found to be quite suitable for the new purpose. Abrasive economy results because the stone length is about four times normal length and more parts between stone changes are produced.

Fixturing is uncomplicated, with the workpieces being allowed to float between parallel plates. The fixture may be mounted on a rotary indexing table; or is adaptable to straight-line automatic loading and unloading.

Automatic in-process feed and size control is an integral portion of the operation. Here, a typical air gaging system is used having an air cylinder which moves the gaging plug into position to make

New Process Finish - Machines Automotive Parts at a Fast Rate by Stacking Individual Workpieces, Adjacent to Each Other in One Setup, and Honing with a Single Cycle

measurements after every full cycle of the honing tool.

The accompanying illustration shows an application of horizontal stack Microhoning in which seven rocker arms are honed at one time on a Micromatic Model 150 Hydrohoner. An average of 0.0015 in. of stock is removed from each of the 0.783-in.-diam by $\frac{7}{8}$ -in.-long bores. Total cutting time is about 15 seconds for the seven parts, for a per-piece time of about two seconds. Size tolerance is ± 0.0003 in.; and straightness and roundness are held within ± 0.0002 in.

Around the Industry

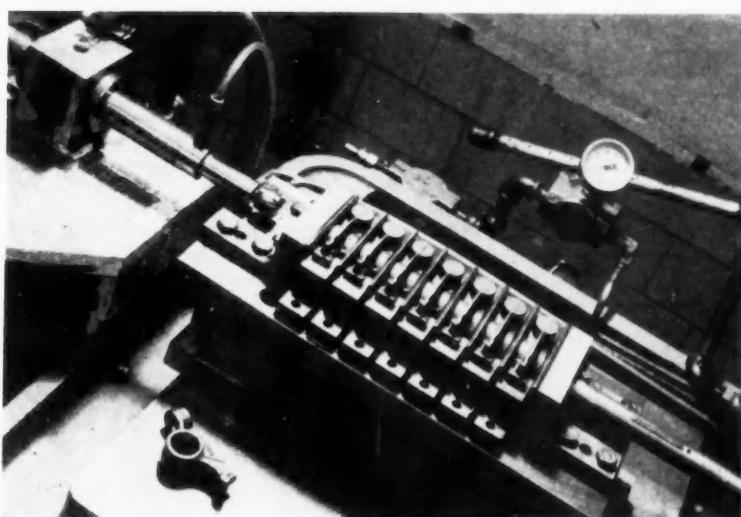
Detroit Broach & Machine Co.—has brought out a line of hydraulic presses, available in sizes from two to several hundred tons, which can perform broaching, assembly or straightening operations. Fully automatic and semi-automatic electrical controls, in addition to manual, are also available; and the presses are adaptable to automatic feeding devices.

Micromatic Hone Corp.—has added to its product offerings the Jones & Shipman (British) line of grinders, which includes tool, surface, and cylindrical types in a number of models.

Pratt & Whitney Co., Inc.—Edward J. Ferris, Jr., has been named factory manager, and Earl R. Lewis, Jr., production manager.

Brown & Sharpe Mfg. Co.—Joseph E. Kochhan has been named assistant general sales manager of Industrial Products Div. Axel Christensen is new sales manager of Brown & Sharpe, Ltd. and has transferred to Plymouth, England.

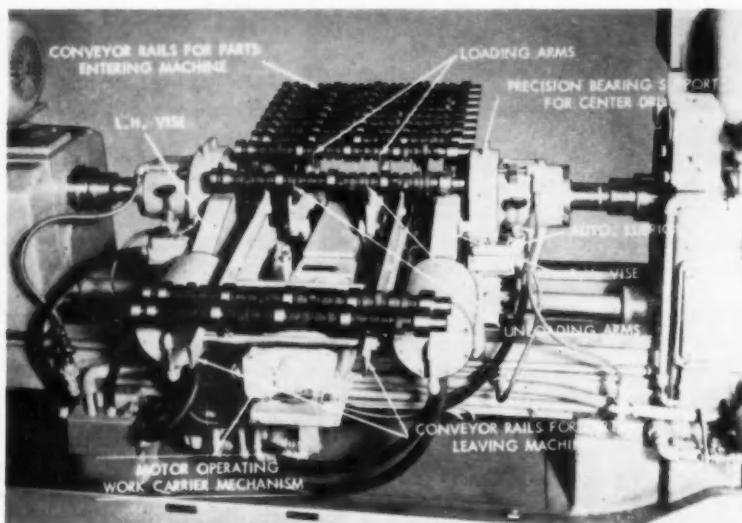
Gulf Oil Corp.—has published an excellent 115-page manual on "Metal Machining with Cutting Fluids."



Application of horizontal stack Microhoning to processing of rocker arms on a Micromatic Model 150 Hydrohoner, in which seven workpieces are handled in one setup

NEW PRODUCTION and PLANT EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card at back of issue



The automatic "Walking Beam" loader loads a rough piece and unloads a finished piece

Automatic Loader Used in Machining Cam Shafts

EIGHT cylinder cam shafts are automatically loaded, centered and unloaded using a "Walking Beam" loader, designed for use with the Model CS Automatic Drilling and Centering Machine manufactured by *Seneca Falls Machine Company*.

The cam shafts are transported from the previous operation by conveyor and roll down to a fixed stop on the loading rails. The "Walking Beam" loader loads a rough piece and removes a finished one simultaneously. At the end of the machine cycle, the center drills retract

and the vises open, allowing the finished piece to drop into a stationary cradle which is positioned slightly lower than the center line of the vise jaws. An electrical contact in the cradle starts the "Walking Beam" motor thereby imparting a rotary motion to the carrier arms. The unloading arms pick up the finished piece and deposit it on conveyor rails, and at the same time the loader arms pick up a rough part and lower it into the vise jaws, which automatically clamp it into position.

Circle 35 on postcard for more data

Retractable Work Chute

A RETRACTABLE work chute, designed to catch finished workpieces as they are cut off on 2AB single spindle bar automatics, has been developed by the *Warner and Swasey Company*.

Powered by the machine's standard hydraulic system and operating independently of the pentagon turret, the new work chute transfers each completed piece to a bin or other receptacle located in the pan of the machine. The chute automatically

moves into position between the 2AB cross slides at the proper time to catch the cut off part, then retracts to avoid any interference with subsequent machine functions.

The new chute, according to the company, is of particular value in the machining of work requiring close tolerances or high quality surface finishes, since it prevents contact or impact between the workpiece and the machine's structure or operating elements following cut off. Once in-

stalled, its use is optional and no special setup is required for the chute's operation on a particular job.

The retractable work chute also can be used for single station operation, again moving into position automatically when the cut-off slide is actuated.

Circle 36 on postcard for more data

Indoor Fork Truck

A NEW 2500 lb capacity gas powered fork truck has been added to the "Clarklift" line of fork-lift trucks produced by the *Industrial Truck Division of Clark Equipment Company*.

Designated model C-25, the unit has cushion tires and is designed for indoor handling and tiering.

Engineered for operations in compact areas, the unit has a turning radius of 64 in. and requires an aisle only 75 in. wide, plus load length, for right angle stacking. It will travel eight miles per hour both forward and reverse and will climb a 23 per cent grade loaded. With a standard upright it has a lift speed of 75 fpm loaded and a lowering speed of 80 fpm loaded.

Lift-lower controls and forward-reverse controls are mounted on the steering column. The truck may be mounted conveniently from either side, and the driver's foam rubber seat is adjustable forward and backward.

The C-25 is powered by a four cylinder Continental gas engine of 112 cubic inch displacement coupled with an automatic Hydratork Drive transmission and Clark torque converter. Final gear reduction is at the drive wheels to reduce axle shaft windup.

Circle 37 on postcard for more data

Finishing Machine

A NEW, improved model of the "Roto-Finish Vibratron" which eliminates the need for manual loading and unloading of parts and media was announced by the *Roto-Finish Company*.

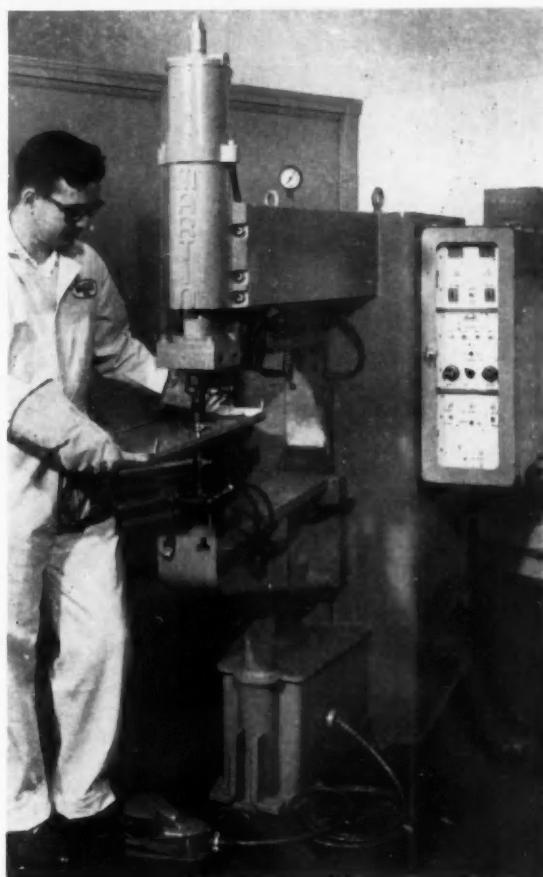
Circle 38 on postcard for more data

Budd Monautronic V-2 Feedback Spotwelding Control

THE V-2 Control obtains correct fusion temperature within each weld by relating the voltage across a given weld area to the ultimate temperature that will occur within the weld. The control system then measures the actual voltage at the weld electrodes and compares this value to a command voltage related to the desired temperature which has previously been programmed into the control; a known quantity based on previous welding experience for the particular type and thickness of metal and the weld strength desired. This command voltage instantaneously compensates for any difference between the two voltages by making automatic heat adjustments for each weld as it is being formed. The feedback information on the voltage across the weld is processed by appropriate input circuits, similar to those used in radar and in both digital and analog computers. This feedback information makes the heat-input setting fully automatic regardless of variations of the type described above. If conditions develop at the weld which would result in a substandard weld and which are beyond the available range of control, the Monautronic V-2 senses that it can't make a good weld under such conditions. It accordingly "locks out" automatically, halting the welding operation.

A new welding control, designated the Monautronic V-2 utilizes the feedback principle to produce conditions that are said to be ideal for spotwelding. This device is designed to automatically compensate for variations in line voltage, applied force, electrode wear, surface finish and fit-up; also thickness or hardness of material, shunting effect, severe contamination and other conditions that would result in substandard welds. Specifications of the Monautronic are: height 30 in., width 12 in., depth 25 1/2 in., weight 200 lb. For the firing unit: height 23 21/32 in., width 10 3/16 in., depth 5 9/16 in., weight 50 lb. The modules consist of a power supply, heat control, sequence and separately mounted firing module.

Circle 39 on postcard for more data



Airless Spraying

NEW airless spraying systems developed by Binks Manufacturing Company, rounds out the line of spray systems now offered by this manufacturer.

With the development of an airless system, the company can evaluate users' spray finishing needs objectively and supply the type system best suited for a particular painting or finishing job. Two basic systems are offered, a 55 and a 5 or 10 gal outfit. With either system, paint is taken from the original container through the Pacer 300 high pressure pump. The pump delivers working pressures up to 3000 psi, when necessary, and supplies enough material to supply two spray guns if needed. Pacer 300 is a 30 to 1 ratio pump that delivers high working pressures developed by low input air pressures.

Circle 40 on postcard for more data

Reduction Drive

A new reduction drive, based upon the cycloid principle of speed reduction, is now being manufactured. As a result of the cycloid design, these drives are said to be 40 to 60 percent smaller than other types of reducers with a comparable rating. The new drives provide a wide selection of ratios, and runs in an oil sealed, cast iron housing. As reported by Black Tool, these units lend themselves particularly well to special applications, especially where weight and space are important factors. *Black Tool, Inc.*

Circle 41 on postcard for more data

Numerical Control Machine

THE application of positioning controls for turning, facing and bor-

ing has been made by *The Monarch Machine Tool Company* to its versatile Series EE, Model 1000 Lathe. A console, located convenient to the operator, provides numerical control through a modified *General Electric* Mark II unit. All of the lathe's regular control features have been retained, making the machine adaptable to conventional manual operation.

Data input is from standard 8 channel, 1 in. wide punched paper tape, prepared on a Flexowriter. A programmer sets up information which is punched on the tape in block form and each block directs the dimension the carriage must move from the zero point, as well as the diameter information for movement of the cross slide. Feed rates are set up as well as spindle speeds and other auxiliary functions.

Circle 42 on postcard for more data



Bench Welder for Critical Work

A SMALL bench welder, designed for extra fine work, has been announced by the Universal Electroweld Division of Electric Arc, Inc. The new machine is one of a new line of single phase welders that has been developed for the resistance welding of all types of welding metals that must meet rigid specifications.

This machine is air actuated and provided with adjustable upper and lower arms and holders.

A ram operating in a lineal ball bearing sleeve and a precision diaphragm cylinder help give the machine special adaptability for fine welding.

Circle 43 on postcard for more data

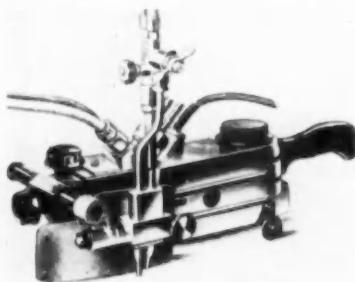
Oxy-Acetylene Cutting

THE portable oxy-acetylene cutting machine, is a light-weight precision device for the automatic flame cutting of ferrous plate up to 2½ in. thick. This machine is capable of rapidly and accurately cutting strip, flanges, circles, angles and

preparing the edges of steel plate with bevel and finishing cuts prior to electric welding.

This cutting machine consists of an adjustable speed motorized drive, supported within a light alloy housing. The total weight is 13½ pounds. Each unit is supplied with fixtures for maintaining the various heating and cutting nozzles in proper alignment, as well as 15 feet of 3 conductor electric cable, a circle cutting trammel for cutting circles up to 40 in. in diameter, a complete set of nozzles and nozzle cleaning drills, a universal spanner, and a copper asbestos shield for protecting the machine from the heat of the flame. *Messer Cutting Machines, Inc.*

Circle 45 on postcard for more data



Messer Cutting Machine

many other complex shapes, virtually on a production line basis. The "Quicky" is also extremely useful for

A GRINDER with an integral gaging system that will grind mating parts to fit within a few millionths

of an inch, has been announced by the Cincinnati Milling Machine Co. This machine is expected to be used to grind such critical parts as missile control valves, fuel injector plungers and precision shaft-like parts. It can also be employed when grinding one of a kind parts such as master gages and other high production parts under gage control.

This machine is said to be able to hold tolerances within 0.000010 in. for roundness, 0.000020 in. for straightness, 0.000025 in. for size and four micro inches for surface finish. The Cincinnati air jet caliper built into the grinder does not touch the work diameter, thus eliminating any chance of chatter or taper due to pressure of the gage.

Circle 44 on postcard for more data

Dynamotive Lift Trucks

SEVERAL new models of their Dynamotive gas-electric pneumatic-tired fork trucks have been announced by Automatic Transportation Co., a division of Yale and Towne Mfg. Co. Models GLFP-40 and GLFP-60 are of 4000 and 6000 lb capacity respectively.

Both models use the Continental F162 model engine, a 4-cylinder L-head power plant of 162-cu. in. displacement, with 3 7/16-in. bore and 4 ¾-in. stroke, supplying 54 bhp at 2150 rpm governed speed. Compression ratio is 8.6 to 1. This engine drives a specially designed variable voltage generator. The truck speed is about 9 mph and reversing is accomplished by a current reversing switch. There is a positive floorboard mounted inching control. Telescopic lift is up to 130 in., mono or duo type, while the nontelescopic lift is 67 in., or 66 in. free lift for the duo type. The hydraulic system has a 7 gal reservoir, and a high capacity output pump driven directly from the engine. Hydraulic service brakes and power steering are additional features.

Use of the generator-motor units in the power train instead of the clutch-transmission means that there is no direct mechanical connection between the engine and the drive axle, and so road shocks are not transmitted to the engine. The electrical system provides a torque multiplication of about 8 to 1, instead of the approximately 2 to 1 in automatic transmissions.

Circle 46 on postcard for more data

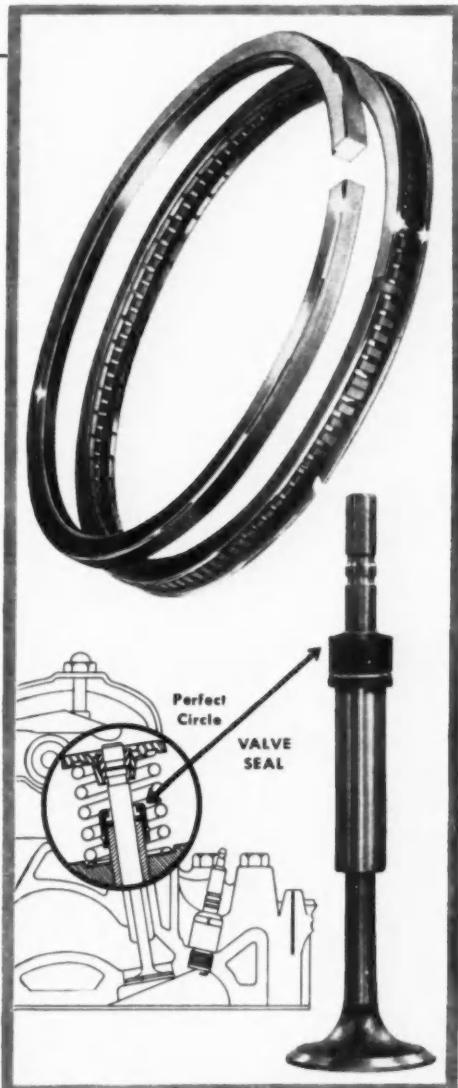
2 reasons why engines get more power protection from Perfect Circle

1. PERFECT CIRCLE CHROME RINGS

**solve problem of excessive
oil consumption past pistons!**

P C chrome piston rings are the finest obtainable! Top rings and oil rings are plated with thick, solid chrome. Entire area of ring travel gets complete wear protection, more than doubling life of cylinders, rings, pistons. No tedious break-in is necessary because rings are pre-seated at factory.

SPECIFY P C CHROME RINGS for thousands of extra miles of power protection with positive oil control!



2. PERFECT CIRCLE VALVE SEALS

**solve problem of excessive
oil consumption past valves!**

New overhead valve engines develop higher compression pressures...and higher deceleration vacuum. Increased vacuum draws oil through loose or worn valve guides. Avoid this oil loss with new Perfect Circle Valve Seals!

SPECIFY PERFECT CIRCLE VALVE SEALS to control oil loss through valve guides in overhead valve engines.

PERFECT

PISTON RINGS AND

Hagerstown, Indiana



CIRCLE

POWER SERVICE PRODUCTS

Don Mills, Ontario, Canada

NEW

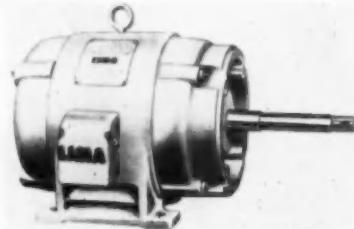
PRODUCTS

AUTOMOTIVE · AVIATION

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

New Pump Motors

A new line of close coupled pump motors range from $\frac{1}{2}$ hp at 900 rpm to 75 hp at 1800 rpm. Explosion proof and totally enclosed range from $\frac{1}{2}$ hp at 900 rpm through 30 hp. The newly designed frames are cast iron



Lima's Close Coupled Pump Motor

with integrally cast feet. The cast iron endbells have precision machined registers and bearing fits and the bearings are prelubricated and sealed. The close coupled model can be supplied in two or three phase, and in all frequencies and commercial voltages below 600 volts. *Lima Electric Motor Co., Inc.*

Circle 50 on postcard for more data

New Spark Plug Design

A new spark plug design that is said to eliminate side wire burning and excessive gap growth has been developed. In addition to the improvement in electrode life, the new "extended shell" design also guards against flooding of the electrodes. These new plugs have been tested for more than 3,000,000 miles of driving, in 253 different late model automobiles. *AC Spark Plug.*

Circle 51 on postcard for more data

Needle Bearings

Needle bearings with a bore range of $\frac{1}{8}$ to $1\frac{1}{8}$ in. are now available in a line that features spherical end needle rollers. All sizes of these bearings exceed the requirements for speeds up to 6000 rpm. Components for which these bearings are adapt-

able are automotive transmissions and steering mechanisms, aircraft components and various power tools. *The Kaydon Engineering Corp.*

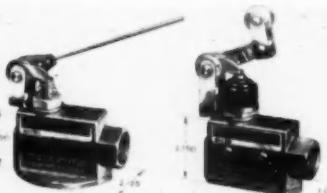
Circle 52 on postcard for more data

Machine Actuators

New one way roller arm and rod actuator versions of the "E6" and "V6" family of easy to wire enclosed switches are now available.

One way roller arm actuators, that provide electrical actuation in one direction only, are designed for either side or bottom mounting.

They are designed for use with machine tools employing a slide to actuate the switch and override it, but not actuate it on the return stroke. A sealed plunger protects the actuating mechanism and switching unit from dirt and splashing liquids.



The new Micro Switch rod actuator

Also available are side and bottom enclosed switches, that feature a low force 6 in. rod actuator. They are used with counters, conveyors and sorting devices. The rod may be cut or formed to meet individual requirements.

Both actuator types are field adjustable horizontally and vertically. Contact arrangement is single-pole double-throw. *Underwriters' Laboratories* listing: 15 amps, 120, 240, or 480 vac; $\frac{1}{2}$ amp, 125 vdc; $\frac{1}{4}$ amp, 250 vdc. *Minneapolis-Honeywell Regulator Co.*

Circle 53 on postcard for more data

**AUTOMOTIVE INDUSTRIES
KEEPS YOU INFORMED**

New Automotive Finish

After two years of research a new high gloss automotive paint has been developed for the industry. Designated as Diamond Black number 75, it is said to dry quickly to a hard, deep finish. *Acme Quality Paints, Inc.*

Circle 54 on postcard for more data

Band Pass Filters

Miniature band pass filters, designed specifically for aircraft and missile applications, cover the frequency range from 200 to 2400 mc. Bandpass may be set at any value between 5 and 25 pct. The number of selections may be varied from 2 to 4, with an insertion loss of 0.5 ± 0.2 db per section. The electrical performance of the filters corresponds to resonant cavities or tank circuits having unloaded Q's of over 200.

A feature of the new filters is their small size. Diameter of the units is only slightly over that of the BNC connectors at each end. Units with other standard connectors are also available. A lumped constant filter design is used, with capacitance obtained by using close-tolerance machined teflon and silver-plated brass parts. Special temperature resistant coil forms and spacers insure a high degree of mechanical stability



Small filters designed for aircraft

tures higher than 100 C. and permit operation at tempera-

The small size and rugged design of the Telonic TBP Filters make them ideally suited to missile and aircraft applications. They are capable of withstanding all of the principal environmental stresses encountered in equipment designed for this use, including shock, vibration, temperature cycling and high G forces. *Telonic Engineering Corp.*

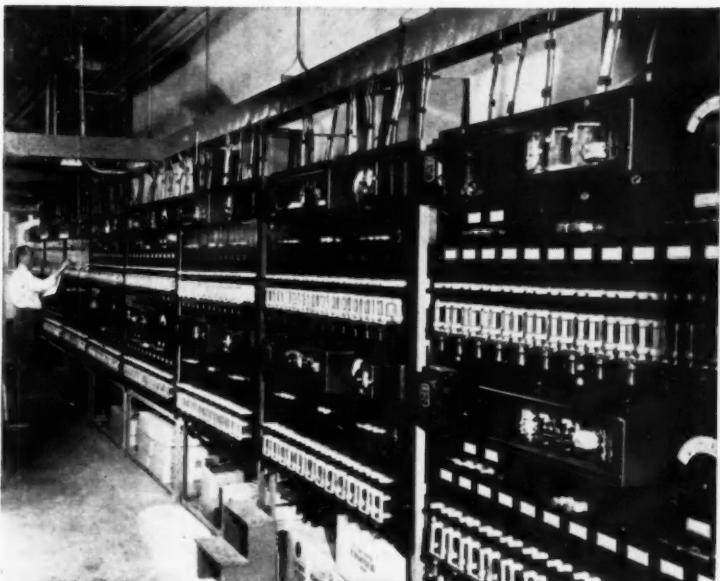
Circle 55 on postcard for more data



to GLOBE RESEARCH no battery is ever perfect

from **Globe Research**

**regular battery examinations
assuring long life and rated power**



Periodic laboratory testing is a *must* if strict quality control of batteries is to be maintained. Globe answers this requirement with the industry's most intensive testing program — batteries taken from the production line at 16 plants undergo all of the SAE tests to guarantee meeting all standards.

Globe tests a minimum of 15,000 batteries annually at their Milwaukee facilities. These same rigid tests are also conducted on experimental and competitive batteries.

It is this continuing program of quality control that makes Globe Spinning Power Batteries unsurpassed in quality for either original equipment or replacement. Write today for more information on the battery that's right from the start.

▲ PULSE TAKER

Trained Globe technicians test production batteries on SAE cycle life test machine. Checks such as this assure delivery of rated starting power and warranted life.

► ANATOMY OF A BATTERY

After SAE tests, Globe specialists perform "autopsies" on dead batteries to determine cause of failure. Separators, grids and plates are examined; active material is weighed; measurements are taken of grid sections to ascertain extent of grid corrosion.



GLOBE-UNION INC.

MILWAUKEE 1, WISCONSIN

For original equipment or replacement Globe Spinning Power Batteries are readily available from 16 strategically located plants.

If it's Petroleum-powered there's a GLOBE-BUILT BATTERY right from the start!

Liquid-Cooled Brakes Solve Heat Problem

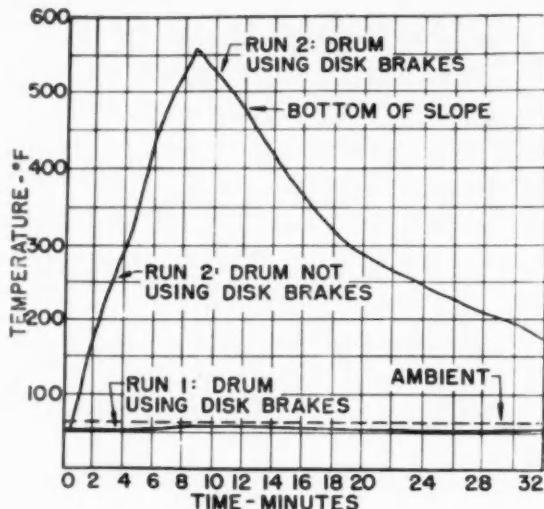
ABOUT a year ago we announced and described a unique liquid-cooled disk brake made by Wagner Electric Corp. (see AI Nov. 15 and Dec. 1, 1958).

Since that time, Wagner has conducted a continuing series of both dynamometer and road tests of the new units.

In one of these tests, using eight conventional brakes, a tractor-trailer combination of 60,000 lb. G.C.W., traveling down the south slope of Tejon Pass in California, recorded brake drum temperatures of 560 F after only 3 miles of travel. In the same run, using liquid-cooled disk brakes on one axle, conventional brake drum temperatures remained at ambient temperatures for the entire 4.3 mile trip. Heat was dissipated immediately from the disk brakes.

A series of tests were run on a 60,000 lb. G.C.W. tractor-trailer combination, according to proposed SAE fade procedure dated 1/15/58. This calls for 20 snubs from 40 to 20 MPH at 10 fpsps. It was necessary to use 5 fpsps because only the disk brakes on the drive axle were used and a higher deceleration would cause tire skid. These snubs were made on a one minute cycle. The disk brake leveled off in temperature after the fourth snub and remained constant for the remaining 16 snubs. Evidently this type of snubbing could occur indefinitely without damaging effects from heat. No recovery time was required since the brakes cooled to the temperature of the coolant as soon as application was released. Brake line pressure remained constant throughout the test. In contrast, similar tests on another vehicle loaded to 25,000 pounds G.C.W., using four drum type brakes, snubbed at a 40 second cycle at 10 fpsps, raised drum tem-

Chart of temperature descending main grade south slope at Tejon Pass in one gear under direct at 20 mph. Length of the grade is 4.3 miles at 5.7 per cent.



peratures on each snub and it was necessary to increase air line pressure a total of 144 per cent to hold the constant 10 fpsps deceleration during the 20 snubs.

Months of testing took place in the brake laboratories and on the inertia dynamometer. The following procedure was used:

The dynamometer was set up for a wheel load of 10,250 lb (nearest dynamometer weights) mass of 318 slug ft², rolling radius of 20.2 in. and a WR² of 902 lb ft sec². The break thermocouples were located in the O.D. and I.D. of both the shield and drum side copper, O.D. of both lining faces and at the coolant inlet and outlet connection to the brake. All temperatures during the test were recorded on a 12-point print recorder. The entire test consisted of five drag tests, five wear tests and five effectiveness tests. The drag and wear phases were conducted alternately; i.e., 1st drag, 1st wear, 2nd drag, 2nd wear, etc. After each test, the brake was disassembled and visual inspection and wear measurements made. The drag tests were run at 2-hour duration at 675 rpm, holding a constant torque of 11,200 in lbs. This speed is equivalent to 81 miles per hour vehicle speed, but was necessary in order to absorb a 120 hp load. The wear tests consisted of 500 inertia stops, made one minute apart from 30 mph, with sufficient line pressure to ob-

tain a deceleration of 11 ± 1 ft/sec². The line pressure and torque were recorded on every tenth stop. Under these conditions, the brake absorbs 70,600 in lb, with an average horsepower absorbed per stop of 140. The effectiveness test consisted of making stops from speeds of 20, 30, 40, 50 and 60 mph, varying line pressure in increments of 200 psi from 200 up to 1225. The latter figure was the skid point of the wheel based on a road coefficient of 0.6 which was equivalent to 125,000 in lb of torque of 19.5 ft/sec² deceleration. During the effectiveness test, torque and line pressure were recorded for each stop. ■

UAW Raises Dues

Members of the giant United Auto Workers union will pay \$2 more a month for dues beginning Jan. 1. The boost, from \$3 to \$5, was voted at the UAW convention in Atlantic City.

Half the increase will go into the union's strike fund. The other half will be split equally between the local union and the International. Thus, the \$5 assessment will be divided \$2 for the local, \$1.25 for the strike fund and \$1.75 for the International.

At the convention, re-elected president Walter Reuther indicated the short work week will be a major demand during 1961.



ONE important feature of automatic production is the storage of shape in dies. This is also the basis of closed die forging—"drop forging". Chambersburg, pioneer builder of equipment for making drop forgings, today builds tools that will shape forgeable materials to close tolerances by a combination of carefully designed die configurations, with

precisely controlled forging blows and a fixed pattern of mechanized stock manipulation. When used with complementary shearing, heating, and trimming equipment, fully automatic or semi-automatic production lines are created which are capable of increased output at lower costs.

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METALS

Five to Six Months Will Be Required to Restore Steel Consumers' Inventories, Provided Strike Is Not Resumed

By William F. Boericke

Aftermath of the Steel Strike

It is becoming increasingly evident that the mere fact that work has been resumed at the steel mills, at least for the 80 day cooling off period, will do little to alleviate the ill effects of the long tieup of production. For many months ahead there will continue to be a steel shortage that will affect the national economy, even assuming there will be no resumption of the strike. It is estimated that to restore consumers' inventories to normal needs will take from five to six months and require that the mills operate at 100 per cent capacity through the first quarter of the new year. There won't be enough steel to go round until spring. There will continue to be a scramble for steel, probably grey markets and premium prices. Emphasis will be placed on production of strip and sheet, the more profitable products and the most needed.

Yet it is true that steel output in the first two weeks after work was resumed has been better than expected. While the full extent of damage to the furnaces and open hearths is not yet known, it seems to be less than feared. It is currently estimated that it will take two to three weeks to reach 80 per cent ingot capacity and four weeks for 95 per cent. At least a month will be required before finished steel can be shipped in quantity. Some steel mills will do better. U. S. Steel has stated it expected to operate at 40 per cent capacity within a week after furnaces were fired, but it is significant that Kaiser Steel, first to sign with the steel workers, did not expect to have finished steel to ship for a month after its men returned to work.

No Assurance of Continued Full Production

Then, too, while the cloud of a renewed strike hangs over the industry there is no assurance there will be 80 days of full output. Aside from start-up delays there will be necessary preparations for a shutdown if the workers go out again. *Iron Age* estimates no more than 50 days of full production in the 80 days period in such event.

If an ultimate settlement is made along the lines of the Kaiser agreement it is likely that steel prices will rise despite U. S. Steel's announced determination to hold the price line. Under the Kaiser contract labor costs were lifted 22½ cents over a 20 month period. In 1956 when costs were hiked 28.7 cents over three years, prices rose 6 per cent.

Strength in Scrap Prices

Scrap prices have strengthened sensibly. No. 1 heavy scrap sold for \$40 a ton in July before the strike began. It slipped to \$38 in August, but has recovered to \$46 by mid-November. Prices could go higher as mills bring more furnaces into production while supplies of iron ore are diminishing. Not much more ore can be brought down the Great Lakes in what remains of the shipping season. The outlook is poor for sufficient iron ore after February. Shipments were hampered by the dock strike which might be resumed and the spectre of a railroad strike is ahead as well. Foreign steel imports which zoomed to 366,000 tons in September have fallen off as work was resumed. Yet is it significant that in the January-September period of this year imports were over 3 million tons, as compared with 1.3 million tons in all 1958. An item of interest was that a shipment of 378 tons of Soviet pig

iron was delivered in Buffalo to an American consumer. Comment seems superfluous.

Unsettled Copper

At mid-November the copper situation was explosive. Prices for the metal varied from 33 cents by the smelters to as high as 40 cents by metal dealers for small lots. The Government was obliged to pay 40.3 cents a pound for 500 tons for the Denver Mint. Kennecott, which had been doling out copper to favored customers in minute amounts at 30 cents, withdrew from the market. London climbed to 33½ cents, or about 35¾ cents delivered in New York, then declined 1 cent a pound on rumor that strikes would be settled at Phelps Dodge mines and that the Government would release stockpile copper. The mercurial market for copper futures on the Commodity Exchange fluttered up and down and copper speculators developed more ulcers.

Metal in Temporary Short Supply

Indisputably copper is in short supply although a comprehensive nation-wide survey by the American Metal Market early in November disclosed that most copper supplies were good until the end of the month. Many copper users were as much concerned by the effect of the steel strike on their business as by worry over a copper shortage. With the end of the steel strike and assurance that at least some steel will be forthcoming to hard-pressed users, it is likely the call for copper will become more insistent. Just from where it can be obtained is hard to say. Demand is good abroad and most Chilean and African copper is consigned to Great Britain and Europe on long term contracts. True, much foreign

(Turn to page 84, please)



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copper has been diverted here as a result of the strikes, which up to November 15 had caused a loss of about 250,000 tons of metal. Net imports in September were 67,000 tons. In the first nine months of 1959, U. S. net imports of copper were up to 250,000 tons, a tremendous increase over the 92,000 tons for all of last year.

Price To Hold Firm

Even if work were resumed immediately at the mines it would still require 60-90 days to fill the pipe lines with refined metal. That is the normal time cycle for converting blister copper into electrolytic. In consequence it would be well into January or later before copper would be flowing regularly to consumers. Copper prices are therefore likely to remain at the present level of 33 cents—perhaps higher—at least through the end of the year and quite possibly into the first quarter of 1960.

Looking further than this it becomes quite debatable if copper prices will hold. World copper output was in excess of consumption prior to the strikes and some substantial new production is coming in 1960. The Chairman of Rhodesian Selection Trust, a big African producer, observes rather pessimistically that copper prices will plummet as soon as the strikes end. Certainly the action of the futures markets which react violently on any rumor of strike settlement would bear this out.

Lead Dull

The lead price continues at 13 cents New York or 12.80 St. Louis. London is featureless, at equivalent of 9 cents. Adding 1.9 cents for duty and freight would mean about 11 cents delivered in New York. Demand has been comparatively light both here and abroad. The bulk of the business is being placed on an average price basis.

London reports that while lead consumption in Europe remains fairly steady, supplies are fully adequate for current needs. Lead

continues to be offered about 3 cents a pound below zinc, in sharp contrast to the situation in this country. There is some reason to believe that because of the good demand for zinc that limitations on zinc supplies instituted some months ago by world producers will be lifted early in 1960. This should result in additional supplies of lead as the two metals are usually mined together. Efforts are being made to stimulate the demand for lead through developing new markets. Some success has been achieved but the tonnages involved are not large.

Statistical Position Improves

Receipts of lead in ore and scrap by U. S. smelters fell to 17,000 tons in September compared to 23,800 in August. This was less than half the receipts in the same month a year ago. Refined stocks of metal at the end of September were down to 109,500 tons, representing a decline of 50,000 tons from a year ago. Lead imports declined nearly 30 per cent from the same period last year, reflecting the effect of the quota restrictions on imports. Domestic mine output was off 12 per cent because of strikes.

Zinc Sales High Prior to Price Advance

In the first half of November sales of zinc were very low. This should cause no surprise, as sales in the last half of October were extraordinarily large, reflecting a rush by consumers to get under the wire at the 12-cent price. They correctly guessed that this price would not last long. Late in October the price was hiked a cent to 13 cents, but this rather drastic increase did not last long. A week later it settled back to 12½ cents where it is apparently firm.

The October figures of the Zinc Institute were quite good. They showed a moderate increase in shipments to consumers and a reduction in stocks. This was the more gratifying because of the continuance of the steel strike during the month.

London Market Continues Strong

The price hike no doubt was instigated by the need for concentrates by U. S. smelters, who have seen their supply diminish from abroad as quotas tightened up on imports. With zinc strong in London at (12 cents) or better, this meant that the metal could not be delivered in the U. S. for much less than 13½ cents a pound. Quite likely there are reasons for the strength in London. Demand has been quite good abroad for both Prime Western and High Grade. Domestic smelters are dependent on imports of foreign concentrates to keep their operations at capacity, and have put pressure on Washington to relax or eliminate quotas. Success is extremely doubtful as the miners are just as much in favor of the quotas as the smelters are opposed.

Aluminum Unsettled

The aluminum industry is unhappy. When Alcoa introduced a new lower cost type of aluminum building sheet priced at 34-35 cents a pound compared to 42-43 cents for some of the older alloys it is designed to replace, there were anguished cries from the independent fabricators who declared their profit margins for re-rolling were nearly eliminated. While the new product was initially proposed for building, it seems likely the new low prices will extend to other fields than building and actually cover more than half of all domestic aluminum business.

It is declared that the move was hastened by increasing competition from imported aluminum products, as well as desire, to break into the market for galvanized sheets, mainstay of the zinc industry. Sheet and plate shipments are the big volume market for aluminum, comprising about 45 per cent of total aluminum mill production. The situation is frankly confused, and might result in a price war, as other producers have met Alcoa's quotations. However, the lower prices apply only to standard sizes in non-specification grades. For specification sheets prices remain firm. ■

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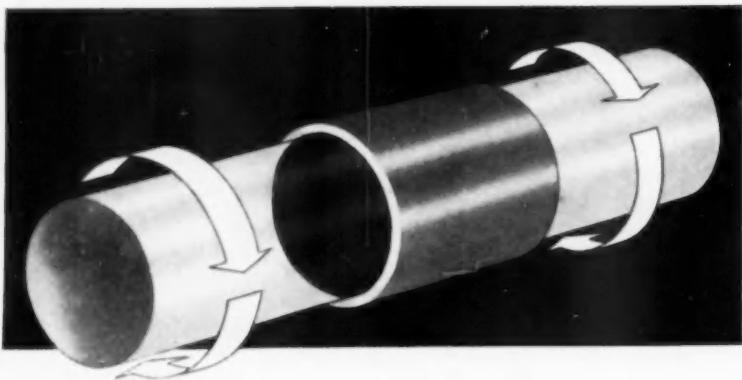
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Computer Cuts Costs

(Continued from page 64)

Data Processing. They did it by developing an "integrated data file," formed around a 650-type computer. This eliminated the need for multiple copies and multiple postings of the same information in many departments, supplied more consistent data, and gave a better understanding of the bases for the data. All departments use the same source, and all data in a report refer to the same point in time.

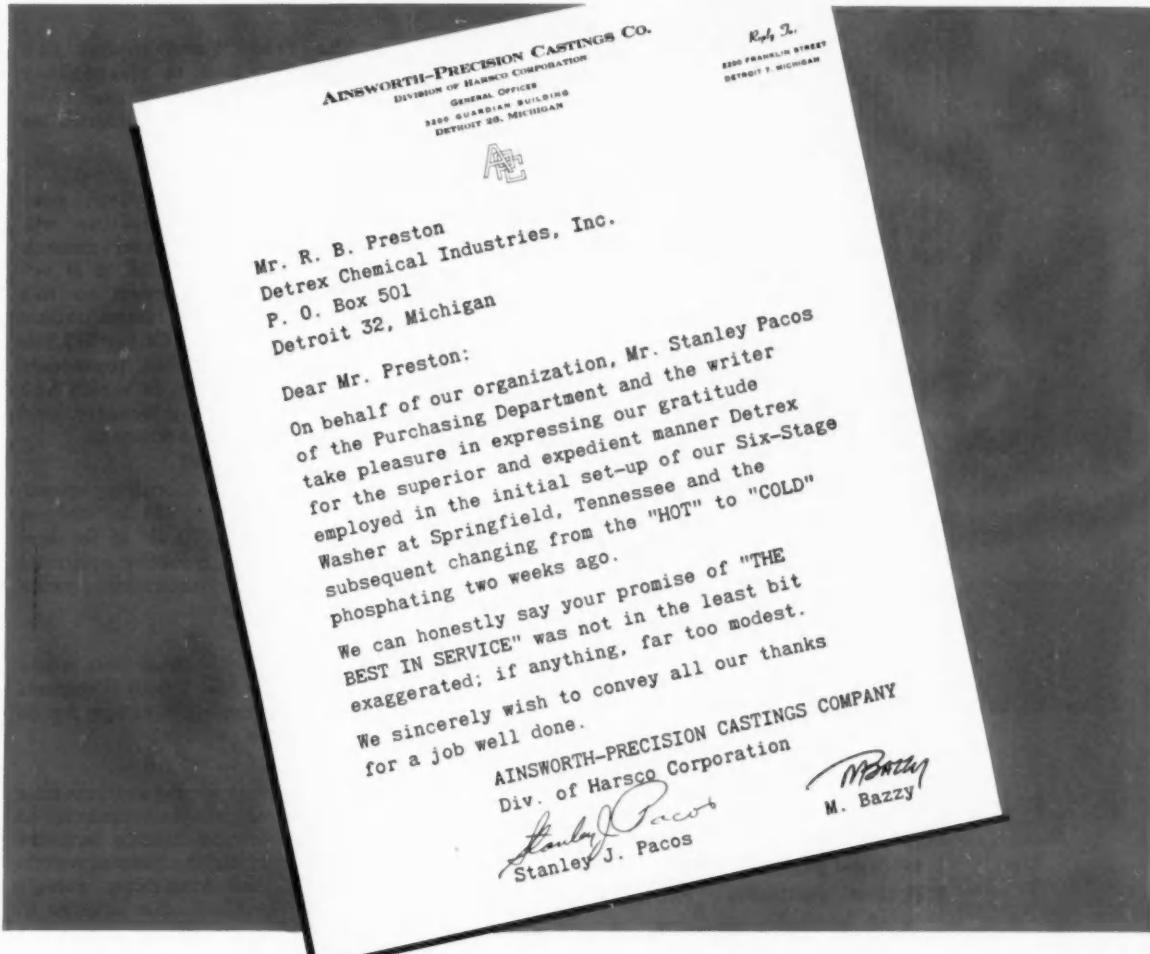
The IDF contains many programs, such as general stores inventory, production material scheduling, personnel salaries and merit rating. Study had shown that there were not over 300 items or separate fields of data in the plant, such as purchase order number, quantity ordered, delivery date. The amount of new data could be coded into less than 200 digits per man per day.

The scale model of the IDF used only the 2000 words on the 650 drum. A scale factor of 300 to 1 was used to reduce the results of the data inventory. The model included sales orders, parts lists, schedules, department budgets, and an updating program for all records, and for printing out reports. Port-A-Punch cards were used for changing data or making inquiries.

In the Integrated Data File, each individual has simple, direct, two-way communication with the computer, and becomes an originator of data. Validity checks in the program screen all incoming data and check the source. As there is no need for extreme speed in communicating, the plant mail system is used to pick up and deliver data. All input data are processed on a two-hour basis. Routine reports requested by a manager or supervisor are processed at night from current status—up-to-date as of 5 P.M., and are delivered at 8:30 A.M. the following day. If the information requested has not been programmed, the request goes to a programmer. By taking advantage of utility routines, a new report can be generated in a short time.

(Turn to page 93, please)

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The Free World added 53.8 million net tons to steelmaking capacity between 1955 and 1958, while Russia and its satellites added 19.8 million tons.

In 1959, American industry, government and universities will spend over \$12 billion on research and development. R & D expenditures have grown to this level at a rate of a billion dollars a year since 1948. Of the \$12 billion total, \$8.7 billion represents industrial research, of which \$4.5 will be financed by industry, and \$4.2 billion by government.

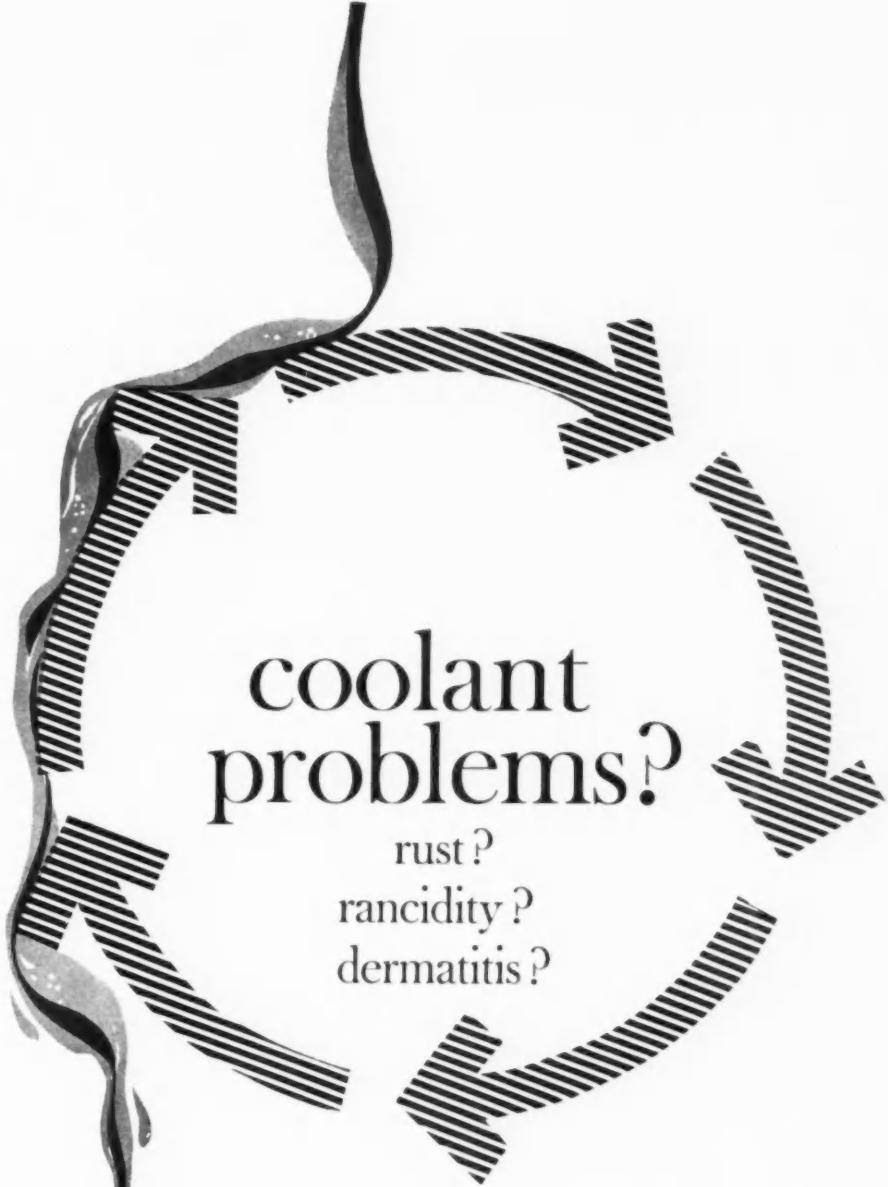
To maintain top cruising speed the new Convair 880 jet airliner uses up to 12,000 lb of jet fuel every hour, a quantity sufficient to drive an automobile twice around the world.

A single jet airliner can waste 150,000 lb of fuel a year if engines exceed normal fuel usage by as little as one per cent.

New rocket engine systems now under intensive development in the aircraft and missile industry will sharply cut the ratio of weight between the launching vehicle and its payload—the satellite itself. The ratio of the first satellites launched was 10,000 to 1, i.e., 10,000 lb of vehicle weight for every pound of satellite placed in orbit. Present rocket engines have reduced this to a 1,000 to 1 ratio. The engine systems we will be using a few years from now will have a ratio between launching weight and payload of about 200 to 1 for interplanetary missions and possibly as low as 50 to 1 for satellite uses.

More than 27,000 new tools were required to produce an improved version of a long-range jet bomber.

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The Eisenhower Administration is secretive about what kind of new anti-steel strike law it will recommend in January. But there is talk of calling for compulsory government fact-finding boards, to be called into play very early in any future national wage disputes. Also, these boards would be armed with power to recommend terms of settlement, something Eisenhower officials have shied away from up to now.

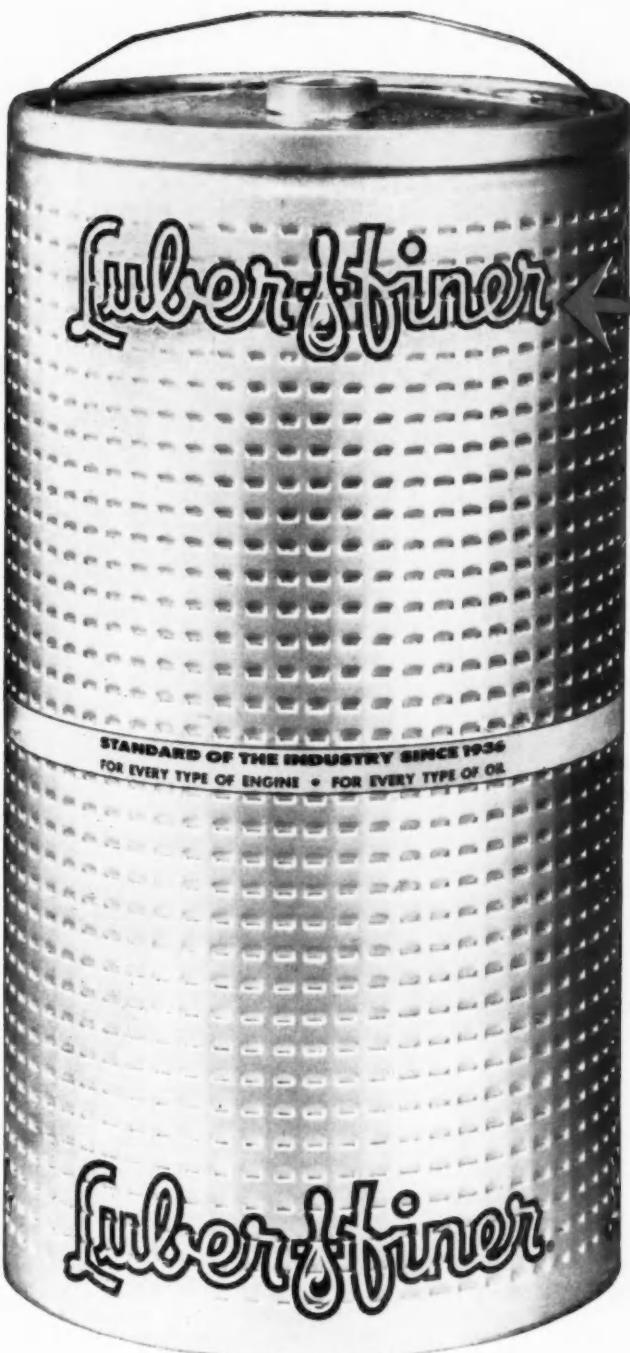
Linking wages to gains in productivity adds further fuel to the fires of inflation, a congressional committee is told. When wages are pegged to productivity in an industry experiencing big gains, similar wage increases are then demanded by workers in other industries, says Prof. Fritz Machlup. His solution: Relate wage rises to productivity gains for the U. S. economy as a whole, not for any specific industry.

Basic research is being pushed aside by the military services in favor of studies which can more immediately be applied. This trend could be dangerous to the country, some top scientists warn.

Particularly singled out is the Navy, which recently received a report from a group of the nation's leading scientists in a scientific advisory committee. The Navy, these scientists say, should spend from 15 to 20 per cent of its \$800 million annual scientific budget on pure basic research. This would be more than double the 6 to 8 pct it now spends.

Members of the committee, which was headed by Dr. C. G. Suits, of General Electric Co., warned that "national survival is largely dependent upon the speed of acquisition and application of new knowledge" in the present era of fierce international technological competition.

It points out that most modern weapons were the direct result of basic research which had no definite products in mind when it was conducted. Radar, for instance, had its roots in discoveries made by the Naval Research Laboratory in 1922, the committee notes. The committee also warns that the U. S. today has only about 27,000 basic research scientists, of whom about half produce 80 per cent of the important results.



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assure trouble-free operation even under the adverse conditions often encountered. In electrical components, the unmatched dielectric strength of TFE resins becomes significant as well.

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Computer Cuts Costs at Bendix

(Continued from page 86)

About 35 per cent of the space in the file is reserved for permanent storage.

The input cards are processed two or three times a day, with an average of about 500 cards each processing. The status tape has 12 active sections, including an inventory status of 4000 production parts and the status of 5000 open purchase orders. Most of the major operating departments have data in the file. When the file is fully loaded, it is estimated it will make 5000 changes per day in four to five minutes. Reports in one month totalled 62, with daily list of receiving reports, purchase order

follow-ups to all vendors with multiple schedule deliveries, material expedite notices, lists of materials due next month, etc.

The cost of individual file posting has been reduced by 50 per cent or more. The cost of posting a single item by a file clerk was approximately 20 cents; punch card filing was equally expensive. In the IDF system, dividing computer rent by the number of transactions, the cost is 9 cents, and should drop to about 5 cents or less as volume increases. Other savings are in the elimination of the duplication of files, and in the cost of summarizing and typing reports by hand. ■

AUTOMATION NEWS REPORT

(Continued from page 69)

tape and compares its keywords with the programmed keywords, picking out the relevant abstracts. The Flexowriter then types out the list of abstracts.

ASM to Launch Center

Early next year, the American Society for Metals will launch its own searching center. The new facility, known as the ASM Metals Documentation Service, is an outgrowth of the pilot program conducted under the society's sponsorship at the Western Reserve Center.

The ASM Service will be built around a new General Electric computer, a high-speed prototype of the WRU machine.

The new machine, designated GE-250, will be able to search 100,000 indexed documents per hour, compared with 30 abstracts for the old WRU unit. It will be able to search a year's output of the world's metallurgical literature in six minutes, a year's output of chemical literature in an hour, or an entire collection of company re-

ports in a matter of a few minutes.

The GE machine will store data on magnetic tape and store search questions in its memory core. As many as 10 queries (on magnetic tape) can be fed into the unit simultaneously.

Coverage Will Be Broad

Marjorie Hyslop, Metal Society editor and director of the pilot searching program, said the service will cover the world's published information on metals. This will include "all their production processes, fabrication, methods, properties and applications, equipment and fuels, and refractories."

The system will be flexible enough to cover fringe areas, Mrs. Hyslop pointed out. Eventually it will handle some 40,000 documents a year, compared with the 12,000 that now are considered to make up the metallurgical literature.

Subscribers to the service will include research laboratories, libraries, Government agencies, and engineering and scientific bodies. ■

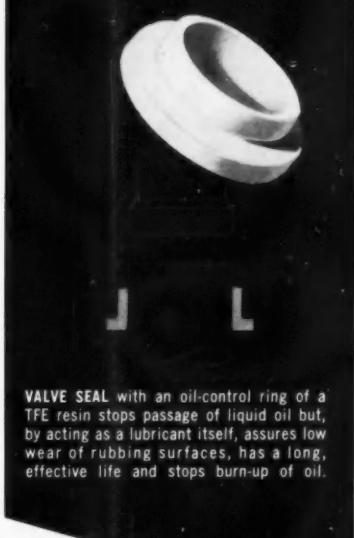
AIR FORCE BUYING

In Fiscal Year 1950, for every four installed engines, the Air Force was buying five spare en-

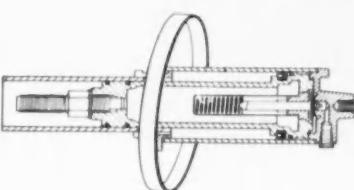
gines. Today USAF is buying approximately one spare engine for every four installed engines.



IMMUNE TO CORROSION of hydraulic fluids, even at the operating temperature of 500°F., over two miles of wiring insulated with a TEFLO resin are used in the engine of this experimental car. TEFLO is one of the best electrical insulations known.



VALVE SEAL with an oil-control ring of a TFE resin stops passage of liquid oil but, by acting as a lubricant itself, assures low wear of rubbing surfaces, has a long, effective life and stops burn-up of oil.



MINIMUM FRICTION in this bus-door control is obtained by the use of a wiper ring of a TEFLO TFE resin supporting the heavy hydraulic piston. The device, not readily lubricated otherwise, depends largely on the self-lubricating characteristics of TFE resins.

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to specs. $\frac{1}{16}$ "— $4\frac{1}{4}$ " cross flats

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Here are a few samples made to customers specifications . . . Our batteries of special high-speed multi-spindle, automatic machines make possible fast and accurate production of hexagon nuts of non-standard height and special shape from carbon or alloy steel, Naval bronze or other non-ferrous metals; also AN 310 through AN 335 as per latest Airforce specifications. Very often the special nut you require may be similar to one we are already making and a simple modification would result in a price advantage and quicker deliveries to you . . . Send us your blueprint and particulars —let us quote on your requirements . . . We also have a catalog that contains complete specifications, engineering data and prices regarding our standard nuts.

Manufacturer of Standard and Special

**12 Pointer, Square and Heragon Nuts
... "Huglock" and "Coelock" locknuts.*

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MS-33514 Flareless tube and gasket seal
MS-24385 Flared tube and gasket seal

Operating Pressure:
1500 PSI and 3000 PSI

Proof Pressure:
2250 PSI and 4500 PSI

Burst Pressure:
4500 PSI and 7500 PSI

Temperature Range:
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Material:
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3000 PSI Stainless Steel

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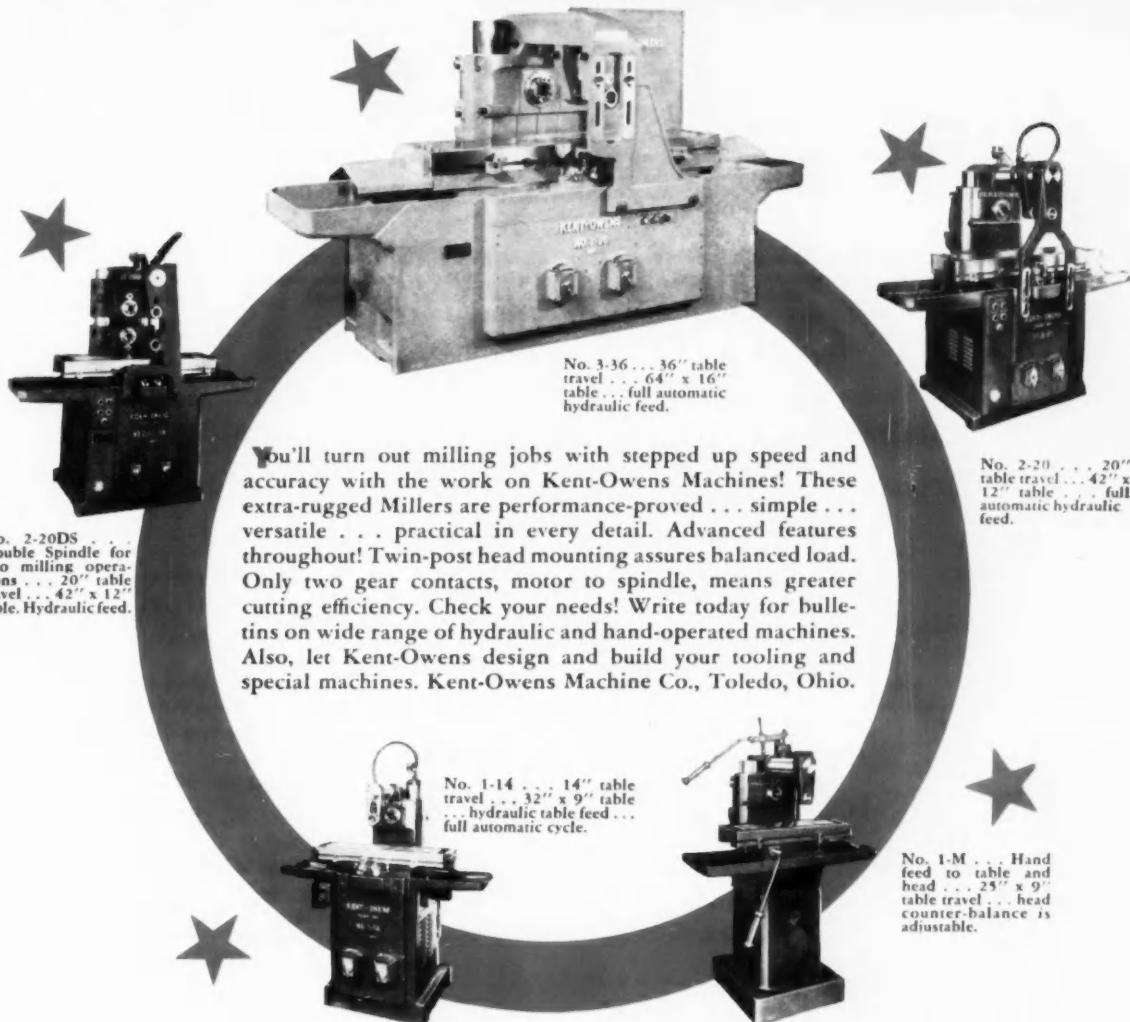
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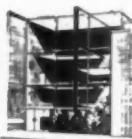
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for milling machines

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FREE LITERATURE

1959 WELDING LITERATURE MASTER LIST

Tubular Welding 1

Fabricators confronted with problems in joining similar and dissimilar metals should benefit from a technical data card that is offered. This card has a list of tubular products, extrusions and seamless welding fittings in addition to the technical information. *Babcock and Wilcox Co.*

Aircomatic Welding 2

A booklet on Aircomatic welding is offered in 24 pages and three sections. It covers the fundamentals of the process, how the process is applied to specific jobs and equipment used. *The Air Reduction Sales Co.*

Resistance Welding 3

Bulletin 318-1 describes SPT-2 spot, and EPT-2 projection welders. This descriptive information is supplemented with dimensional drawings, illustrations and tabulated data to indicate KVA range, throat depth, welding capacities and electrode force. *Sciaky Bros., Inc.*

Welding Control 4

Specifications, capacity of control, applications and new features are completely discussed in a brochure for the feedback spotwelding control known as the Monautronic V-2. Chart and graph style information, along with engineering data, is included. *The Budd Co.*

Welding Wires 5

Illustrations, charts, tables, operating procedures and specifications are provided in a book titled "Aircomatic Welding Wire." Also discussed are applications on stainless steel, copper, steel, aluminum and additional wires. *Air Reduction Sales Co.*

Connections 6

A complete line of cable connections and accessories are listed, illustrated and described in catalog number 12 by *Tweco Products, Inc.*

Tab Weld Resistors 7

A bulletin showing the construction features of tab weld resistors and containing a selection table covering ratings from 13 to 500 amps continuous for various section lengths. *The Electric Controller & Mfg. Co.*

(Continued, next page)

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FREE LITERATURE—(continued)

Welding Line

8

A brochure describing a full line of fine welders has been offered along with a booklet on the principles of arc welding. The latter has many interesting items about arc welding applications. *Miller Electric Mfg. Co., Inc.*

Heliarc Catalog

9

The Heliarc line of manual welding equipment is fully covered in a 20-page catalog that is offered. Accessories are listed in table form and every torch in the line is illustrated $\frac{1}{2}$ actual size. *Linde Co., Div. of Union Carbide Corp.*

Gas Welding Rods

10

An eight page bulletin, designated Number DH-1277-B, describes rod requirements for fabricating ferrous metals and are produced to meet practically all metals of this class. *Page Steel and Wire Div., American Chain and Cable Co., Inc.*

Welding Equipment

11

A manual featuring a full line of gas welding, cutting and allied equipment has been published. In addition to illustrations and product description this literature contains charts and technical data on the various items. *The Smith Welding Equipment Corp.*

Ground Clamps

12

Solid copper ground clamps, in 200 and 300 amp capacity, are described and priced with and without lug or screw connections. This includes the "Big Brute" and a smaller version clamp. *Mneller Electric Co.*

Electricweld Tubing

13

Specifications on "Jal-Smooth," a new drawn-over-mandrel electric-weld tube, are covered in a pamphlet. OD and ID tolerances, microinch finish of the ID, mill test pressure psi, and burst pressure psi are given for the different sizes. *Jones and Laughlin Steel Corp.*

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AC-DC Machines

15

"Quick guide" charts for ac-de welding machines give 12 specifications for 13 ac machines and 21 dc machines. These charts are laid out in machine groups according to their application qualifications. *A. O. Smith Corp.*

87 basic electrode types

16

A new electrode, folder type, catalog that is keyed to new A.W.S. specifications and new NEMA color code is offered. There are nine different colored sections in which 87 electrodes are listed showing specifications, applications and type of metal each was designed for. The other side of this folder shows more detailed information on the best selling electrodes of this line. This latter side contains a separate chart for each individual best seller. *A. O. Smith Corp.*

ORDER YOUR NEW SUBSCRIPTION

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FREE LITERATURE— OTHER SUBJECTS

Hand Chain Hoists 17

An eight page booklet contains tables and recommended minimum on differential worm and spur geared types of hand chain hoists, hook or lug suspension and plain or geared trolley. *Hoist Mfg. Association, Inc.*

Holding Tools 18

A line of work holding tools are featured in a new catalog. More than 68 items are illustrated and described. These include: drill press angle and swivel machine vises, adjustable angle plates, milling and tilting tables, lathe milling attachments and other machine tool accessories. *Chicago Tool and Engineering Co.*

Hydraulic Shears 19

The new line of hydraulic shears is fully described and illustrated in catalog 2030-A. This literature gives charts on the specifications, applications and suggested knife clearance for specific type metals and cuts. *Steelweld Machinery Div., Cleveland Crane and Engineering Co.*

Tensile Testing 20

A 4 page illustrated booklet, bulletin T-859, describes a line of tensile testing machines with capacities up to 40,000 lb. Specifications, descriptions and methods of operation are listed for both manual and hydraulic models. *Steel City Testing Machine, Inc.*

Universal Joints 21

A 16 page engineering bulletin, describing a complete line of universal joints and drives, is offered by *Nepco Products Inc.*

Speed Belts 22

Engineering data, sizes, ratings, alphabetical listing of applications, numerical listing of mfg. part numbers, numerical listing of applications and variable speed cross reference tables are featured in the *Maurey Mfg. Co.'s* catalog on belts.

(Continued, next page)

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Molded Plastic

23

A four page article titled "High Impact Plastics Solve Design Problems" is available. This article discusses the advantages of molded high impact thermo setting plastic products. It also lists hints on how to design parts that will be produced by molding. It is illustrated and gives right and wrong types of part design. *The Continental-Diamond Fibre Corp.*

Power Connectors

24

A twelve page catalog on series 14, 16, EZ and GA continental connectors has been released by the *Electronic Sales Div. of DeJur-Amsco Corp.*

Terminals

25

A bulletin covering a line of glass to metal seals is offered. This illustrated booklet gives electrical specifications and installation data. *Electrical Industries, a div. of Philips Electronics and Pharmaceutical Corp.*

Fasteners

26

A new 1960 catalog about threaded and headed fasteners is offered. It contains the latest price list, and it is said to give the most complete item coverage in this line. *Atlas Screw and Specialty Co. Inc.*

Molecular Bonding

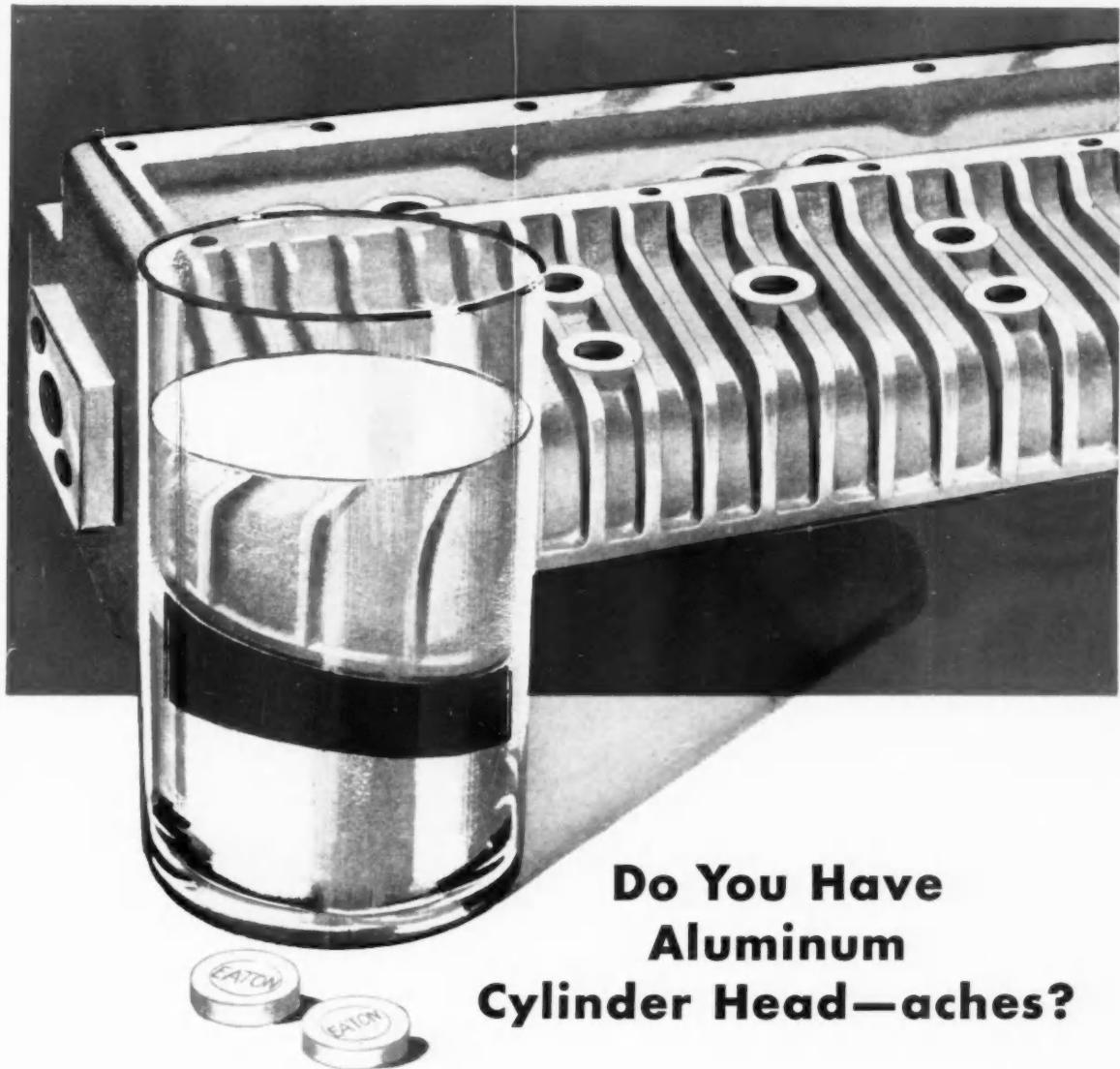
27

A new brochure explains how a new process has solved difficult heat transfer problems by molecularly bonding ferrous components into aluminum castings. This process is known as AL-Fin Molecular Bonding. A free brochure is available from the *Arthur Tickle Engineering Works, 21 Delevan St., Brooklyn 31, N. Y.*

Aluminum Alloys

28

A new revised 12 page brochure, with latest information on aluminum alloys and the aluminum extrusion process, has been released. Included in this bulletin is vital information to aid designers, engineers, and purchasing agents in a quick analysis of aluminum extrusions for a specific use. *Precision Extrusions, Inc. 720 E. Green Ave., Bensenville, Ill.*



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